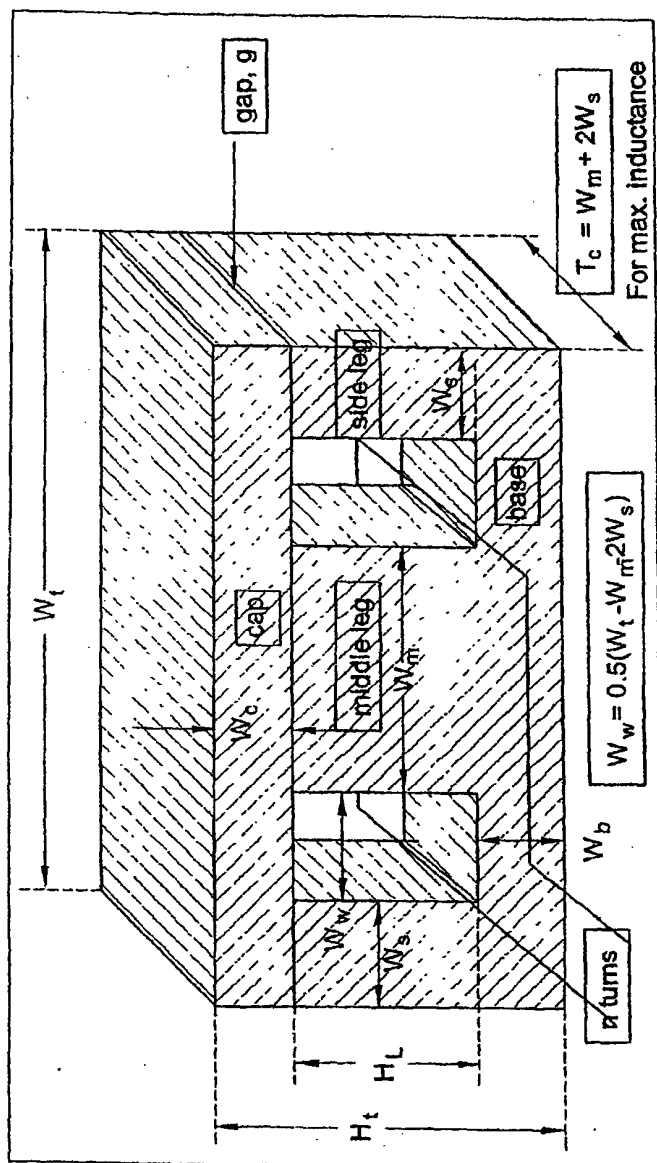


ELECTRONIC TRANSFORMER/INDUCTOR DEVICES AND  
METHODS FOR MAKING SAME

Philip A. Harding

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Ferromagnetic E core with a matching ferromagnetic cap

FIG. 1

ELECTRONIC TRANSFORMER/INDUCTOR DEVICES AND  
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TOROID TRANSFORMER

Top View

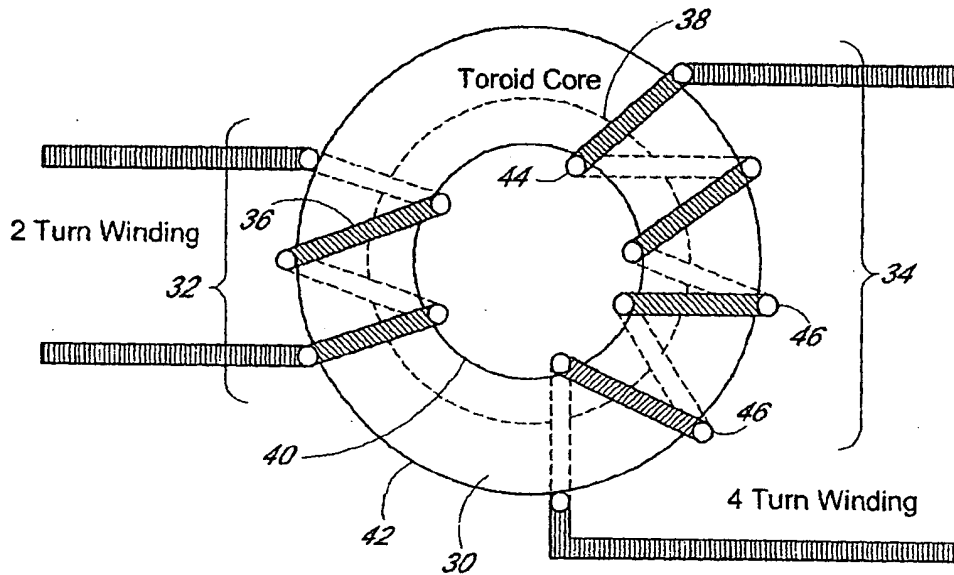


FIG. 2A

Side View

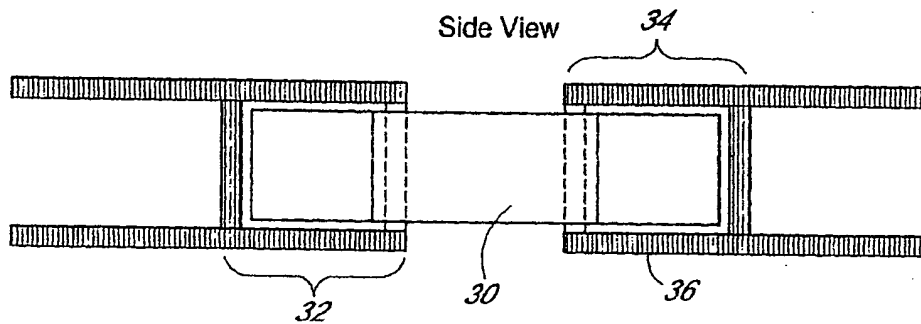


FIG. 2B

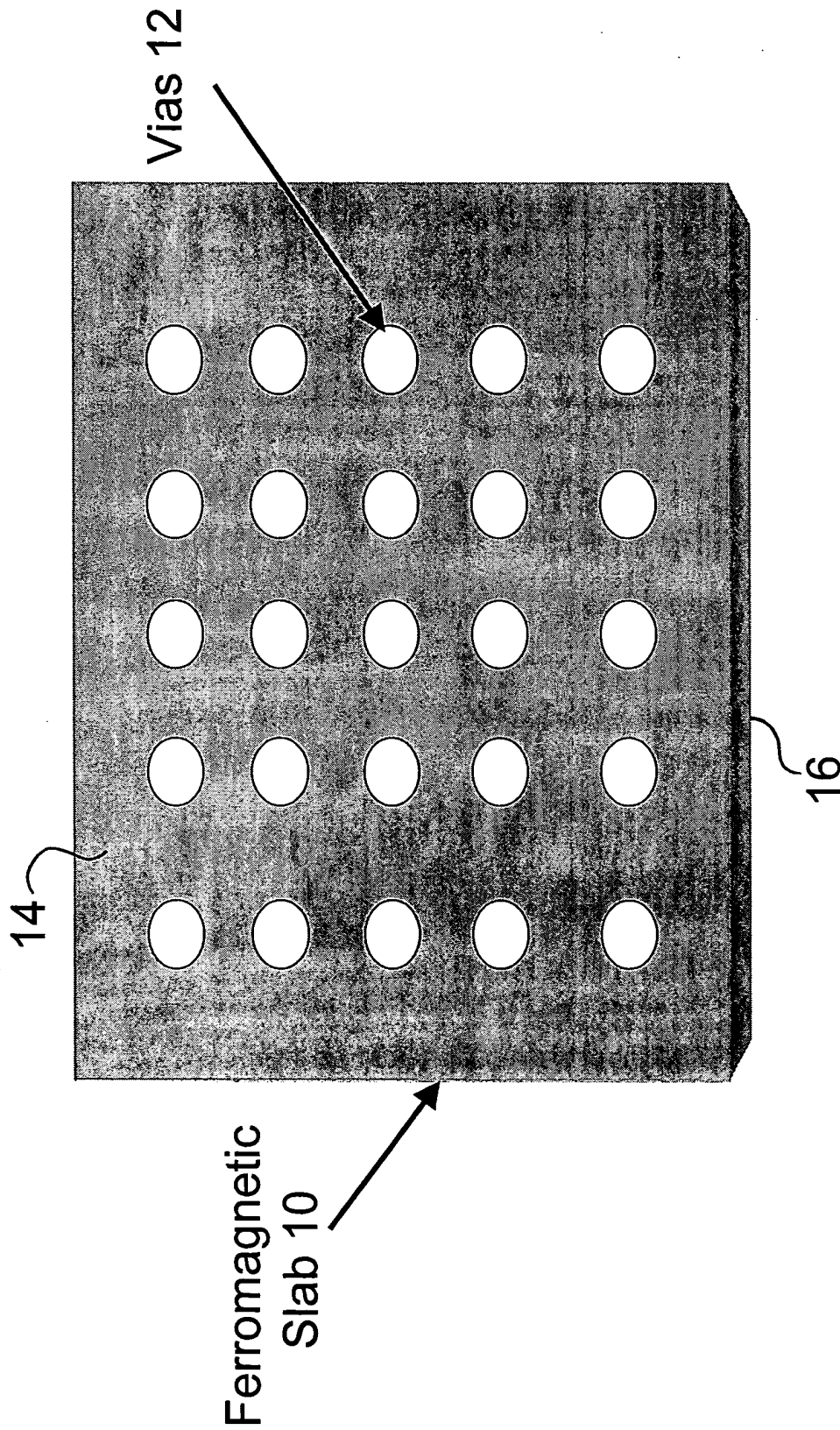
*ELECTRONIC TRANSFORMER/INDUCTOR DEVICES AND  
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*Philip A. Harding*

*Appl. No.: Unknown*

*Atty Docket: MFLEX.007A*

**Ferromagnetic Slab with 25 Vias**



**FIG. 3**

ELECTRONIC TRANSFORMER/INDUCTOR DEVICES AND  
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VIRTUAL TOROID TRANSFORMER

Top View

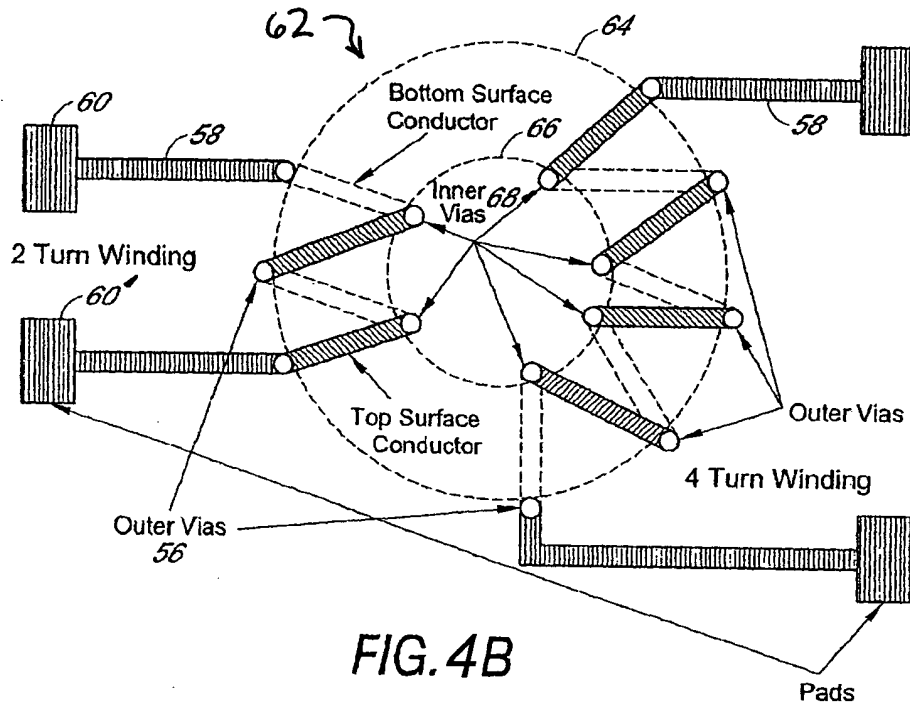


FIG. 4B

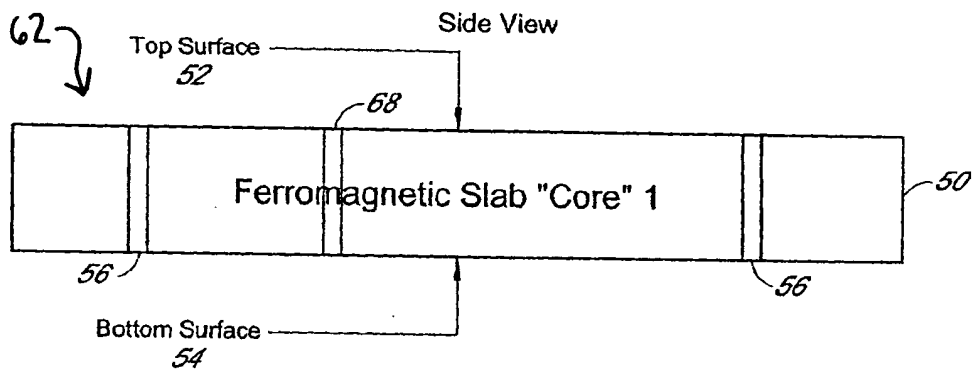


FIG. 4A

VIRTUAL TOROID & RECTANGULAR  
TRANSFORMER SAME SLAB  
Top View

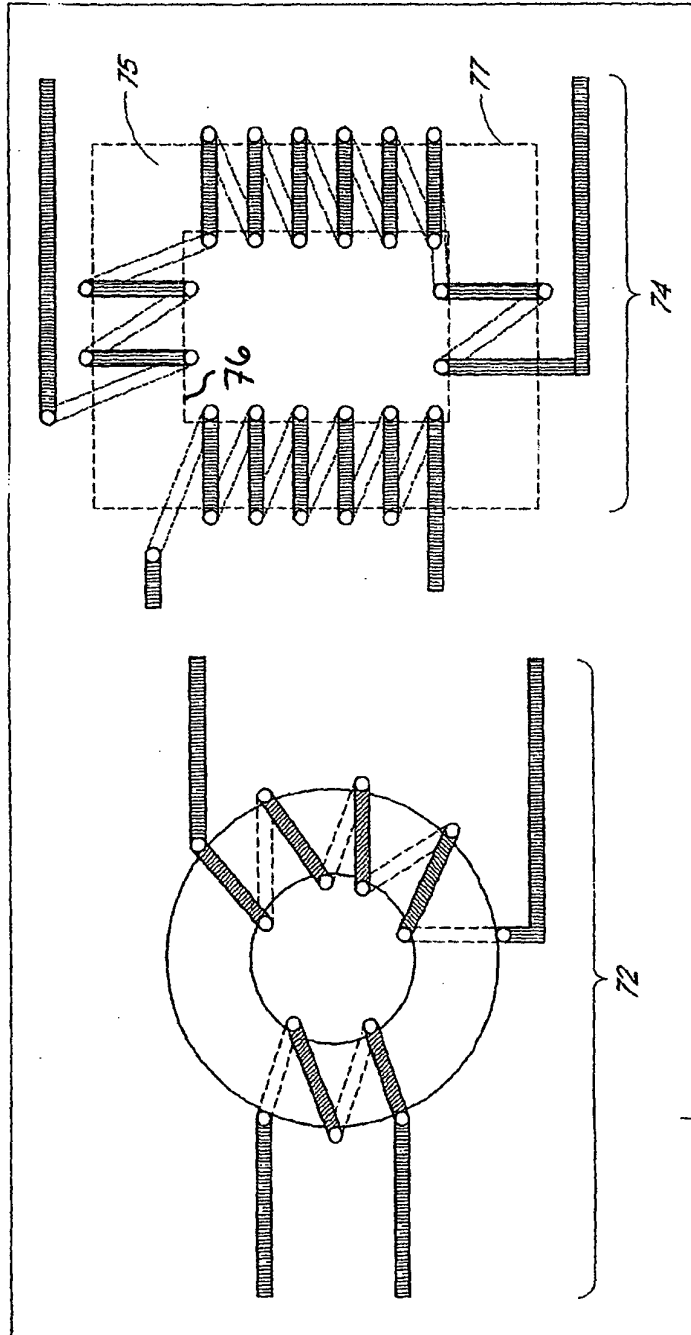


FIG. 5

## A virtual toroid core energized by an 8 turn winding

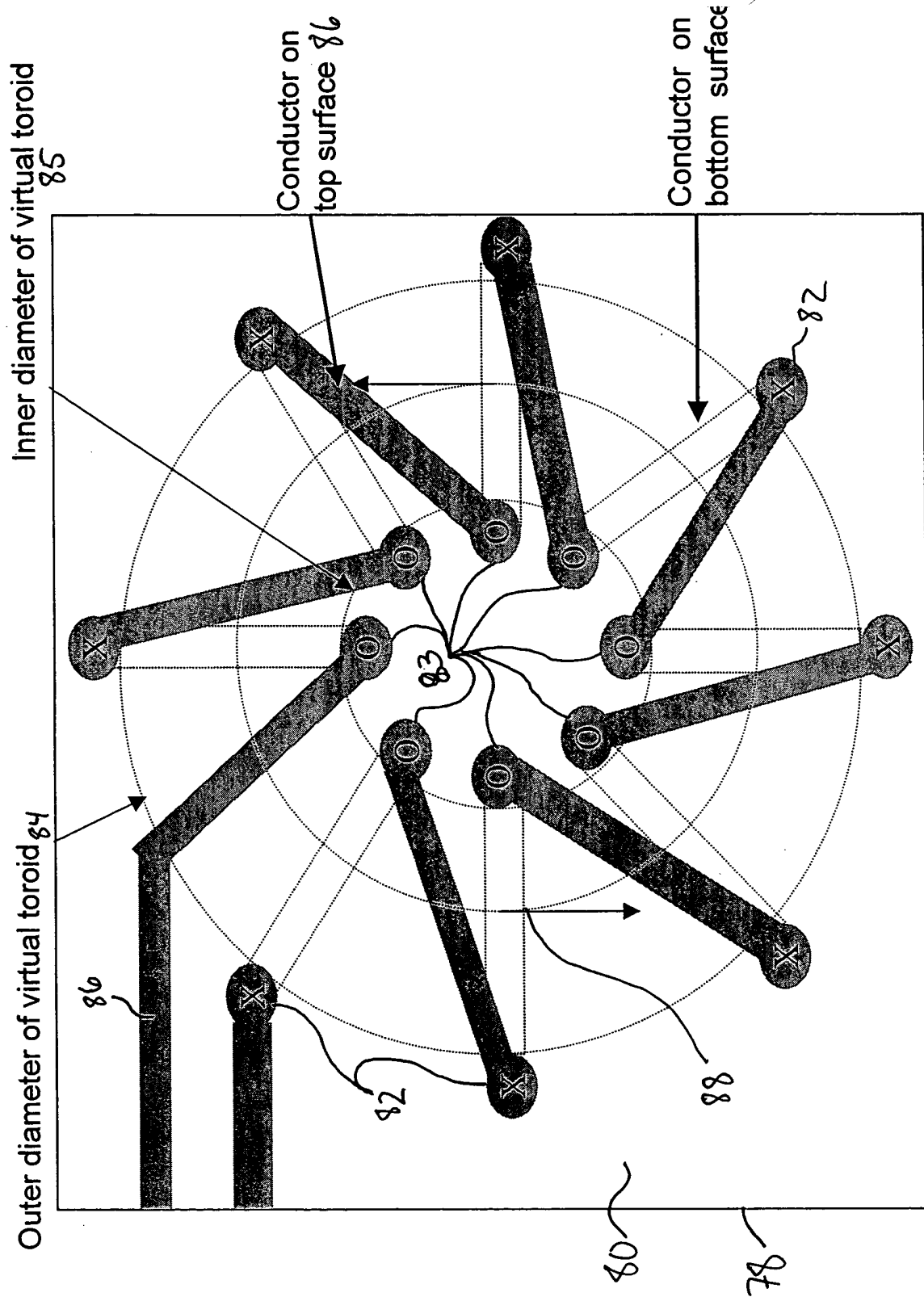


FIG. 6

○ Via with current out of hole

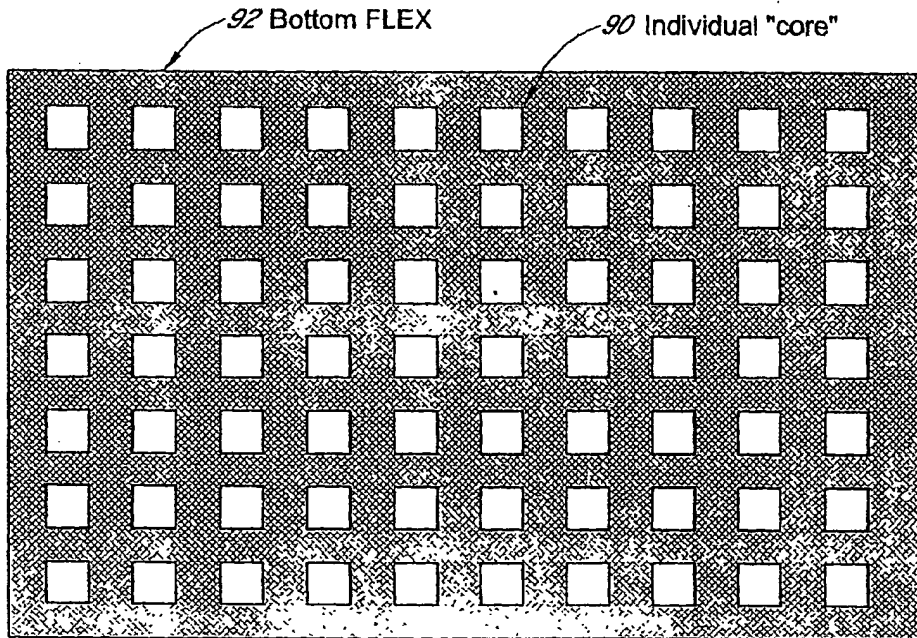
⊗ Via with current into hole

ELECTRONIC TRANSFORMER/INDUCTOR DEVICES AND  
METHODS FOR MAKING SAME

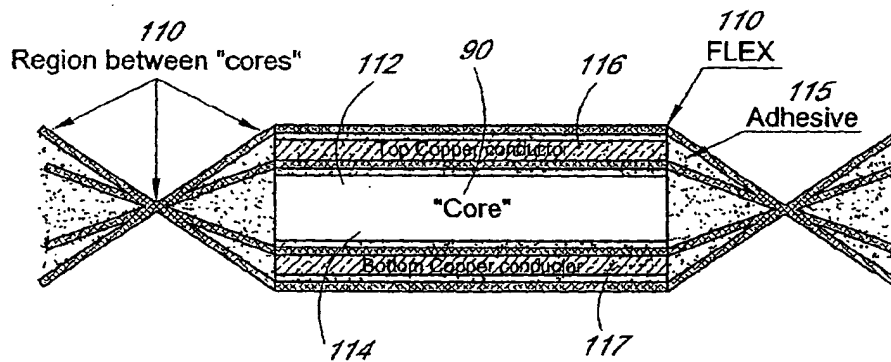
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FIG. 7



Array of 70 cores laminated onto a large panel of FLEX  
(top FLEX removed to show the individual cores)



Side view showing top & bottom FLEX laminated to "core" in a panel of 70 "cores"

FIG. 8

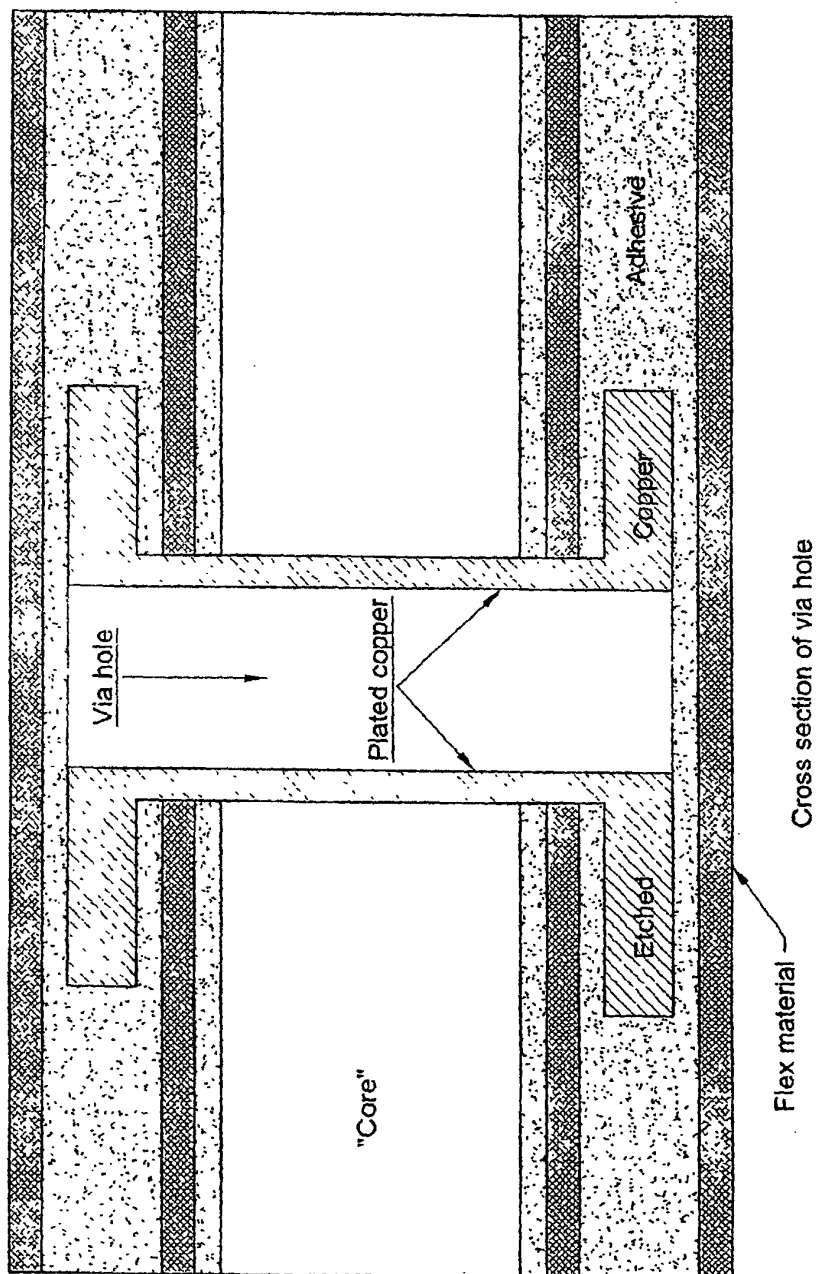


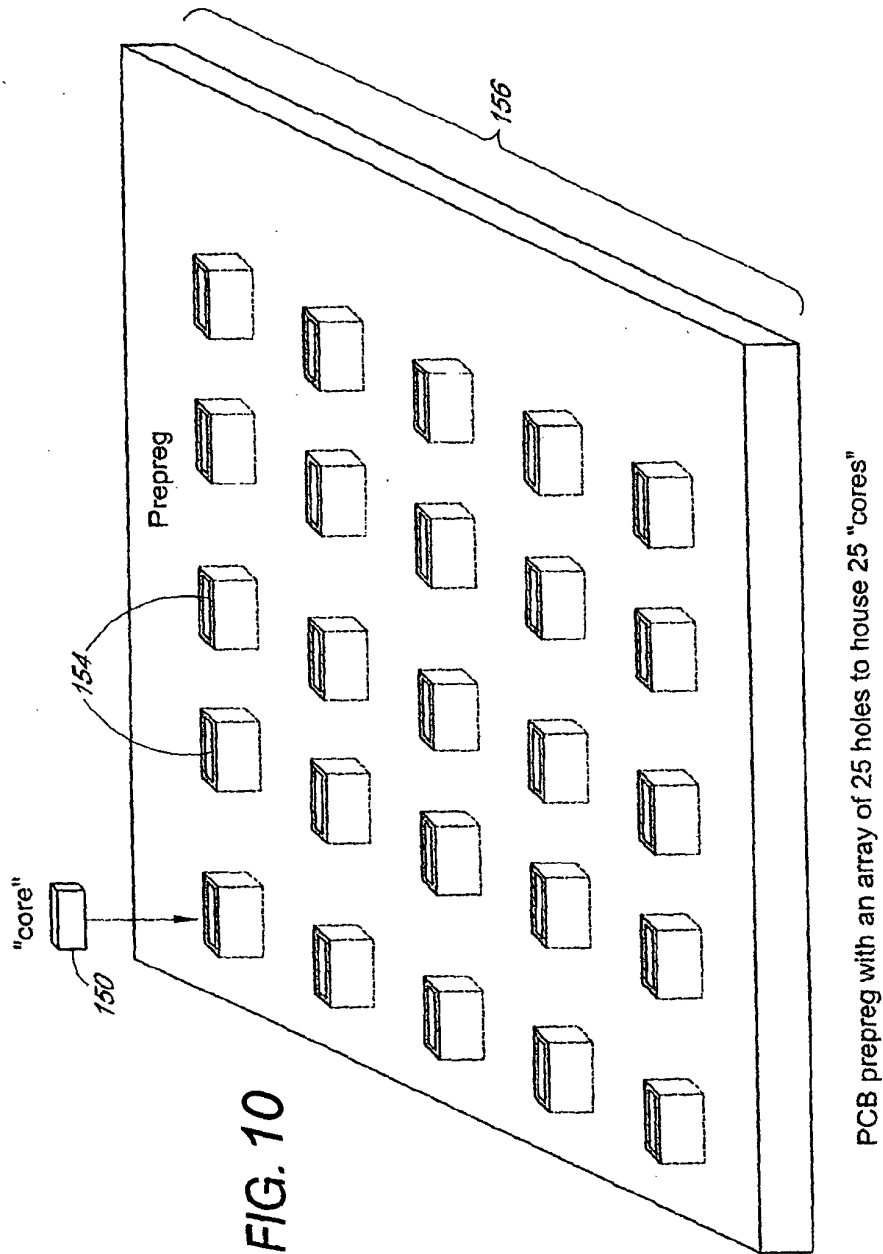
FIG. 9



ELECTRONIC TRANSFORMER/INDUCTOR DEVICES AND  
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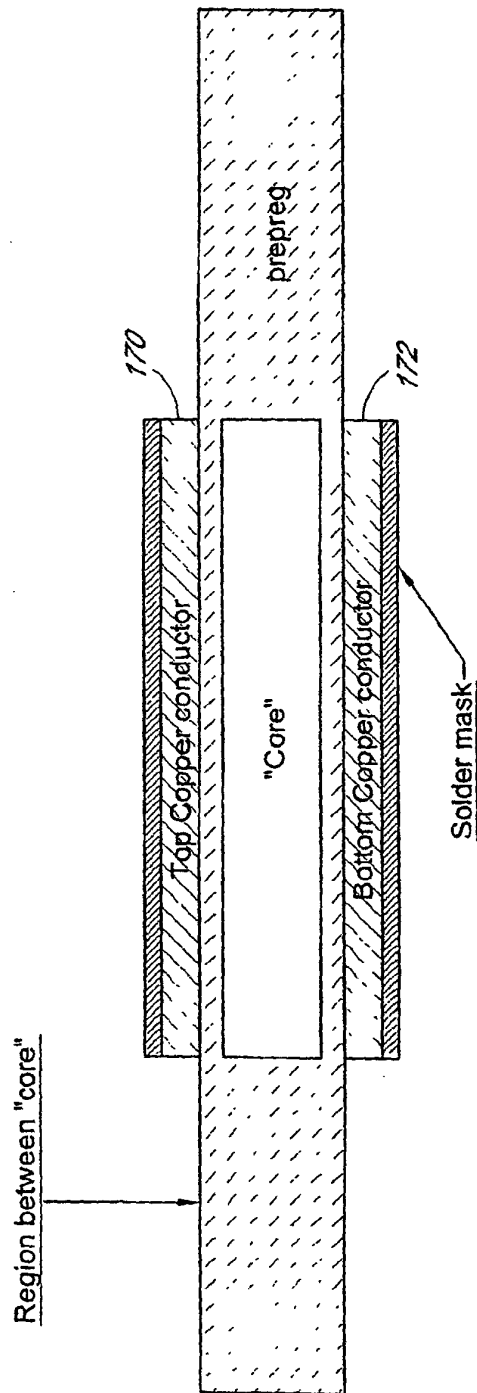


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Side view showing top & bottom PCB laminated to "core" in a panel of 25 "cores"

FIG. 11

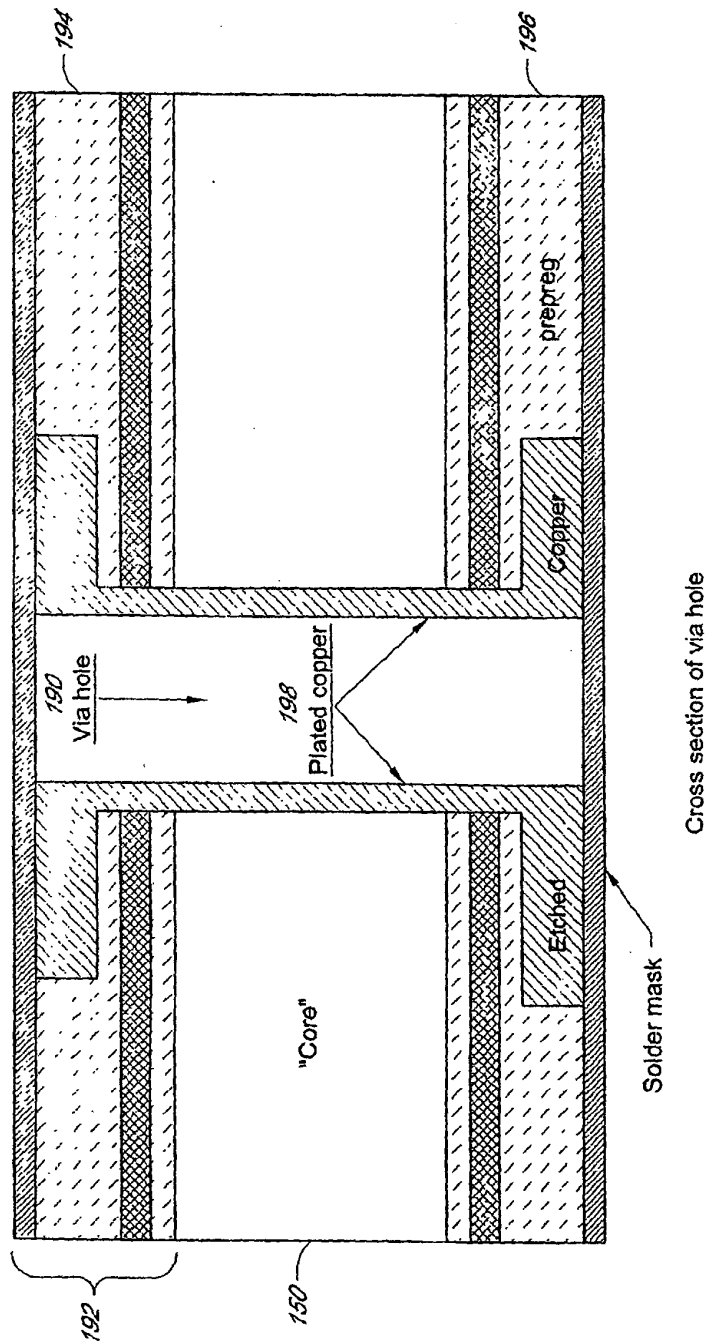
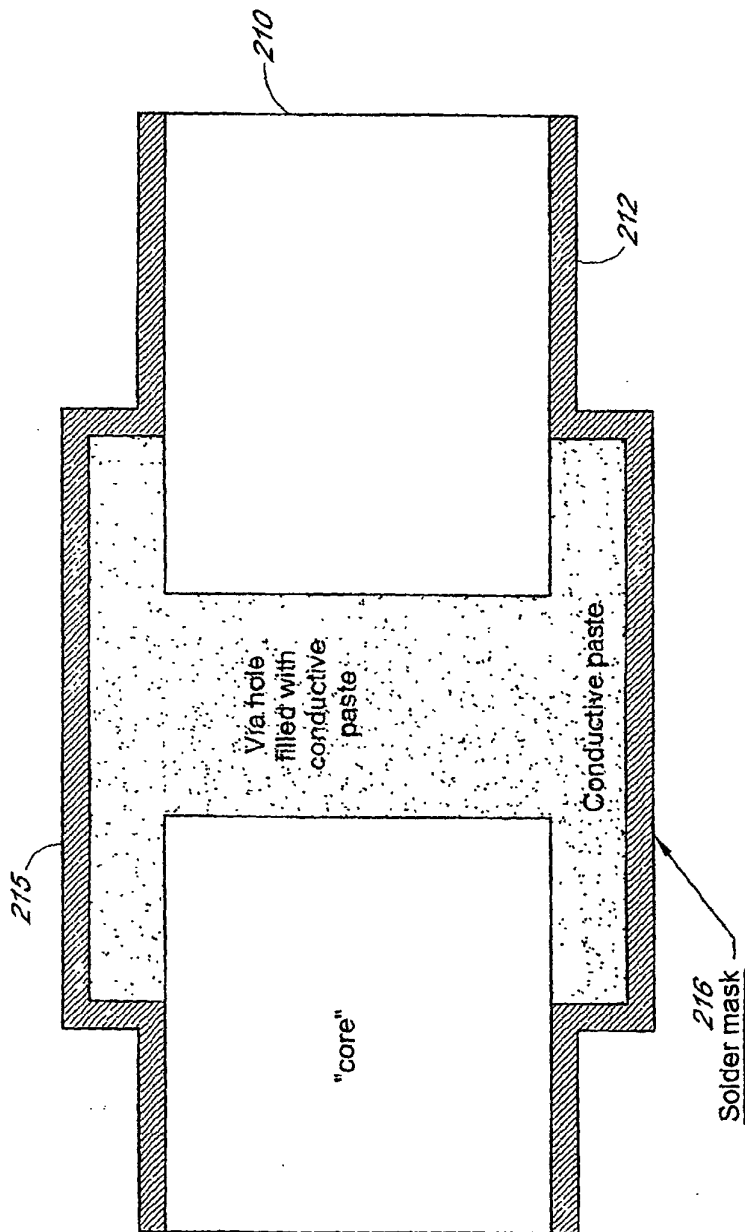


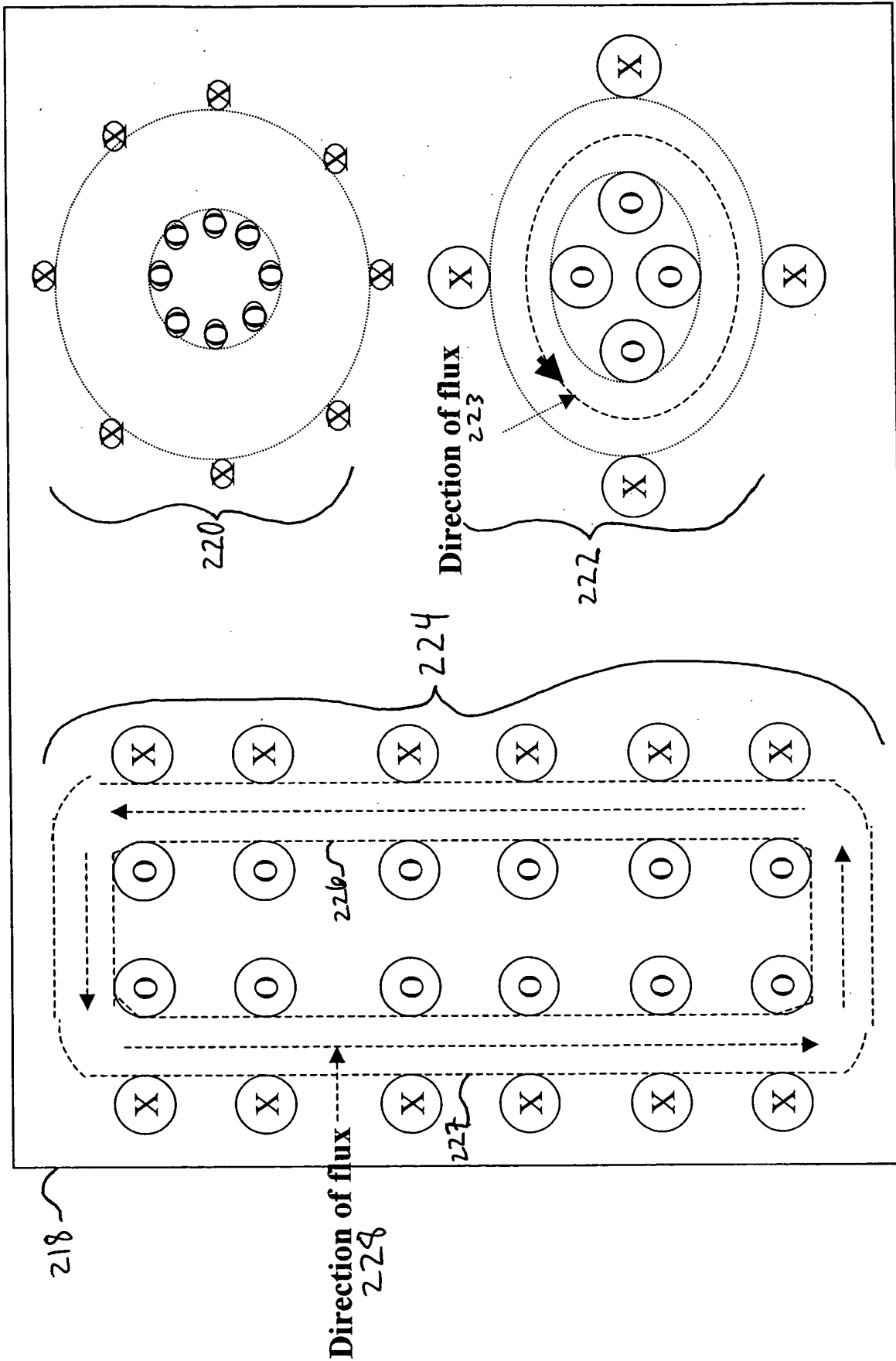
FIG. 12



Cross section of via hole of "core" with screened conductive paste

FIG. 13

**Four virtual cores in same ferromagnetic slab**



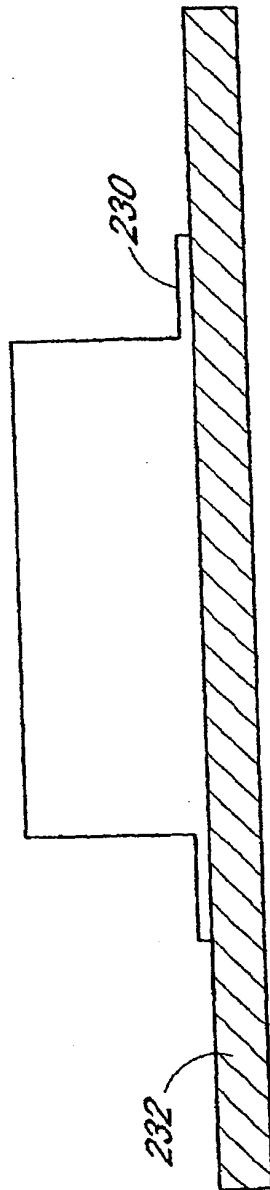
**FIG. 14**

 Via with current into hole
  Via with current out of hole

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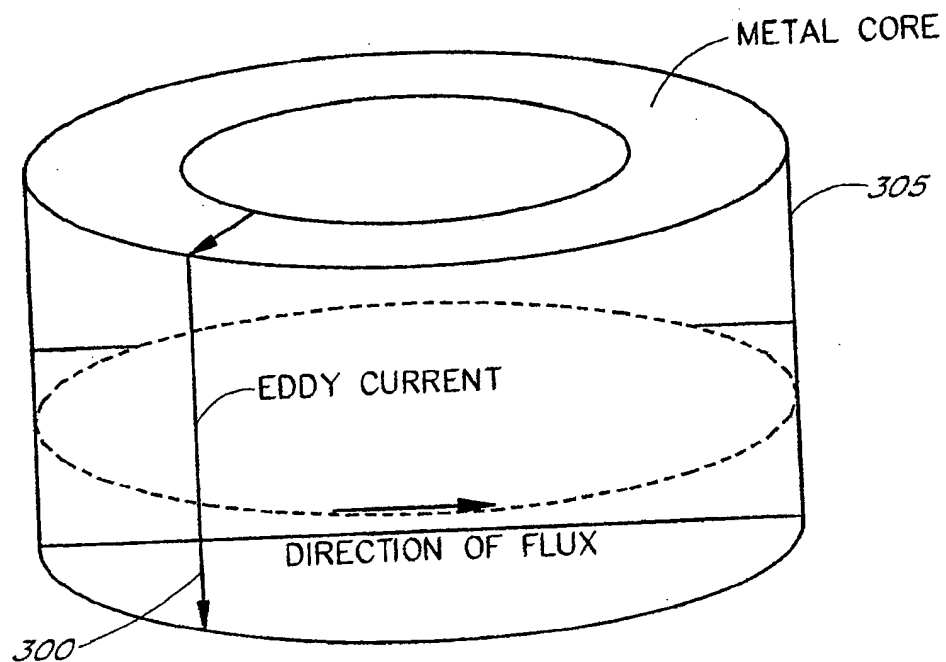


**FIG. 15**

*ELECTRONIC TRANSFORMER/INDUCTOR DEVICES AND  
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*FIG. 16*

ELECTRONIC TRANSFORMER/INDUCTOR DEVICES AND  
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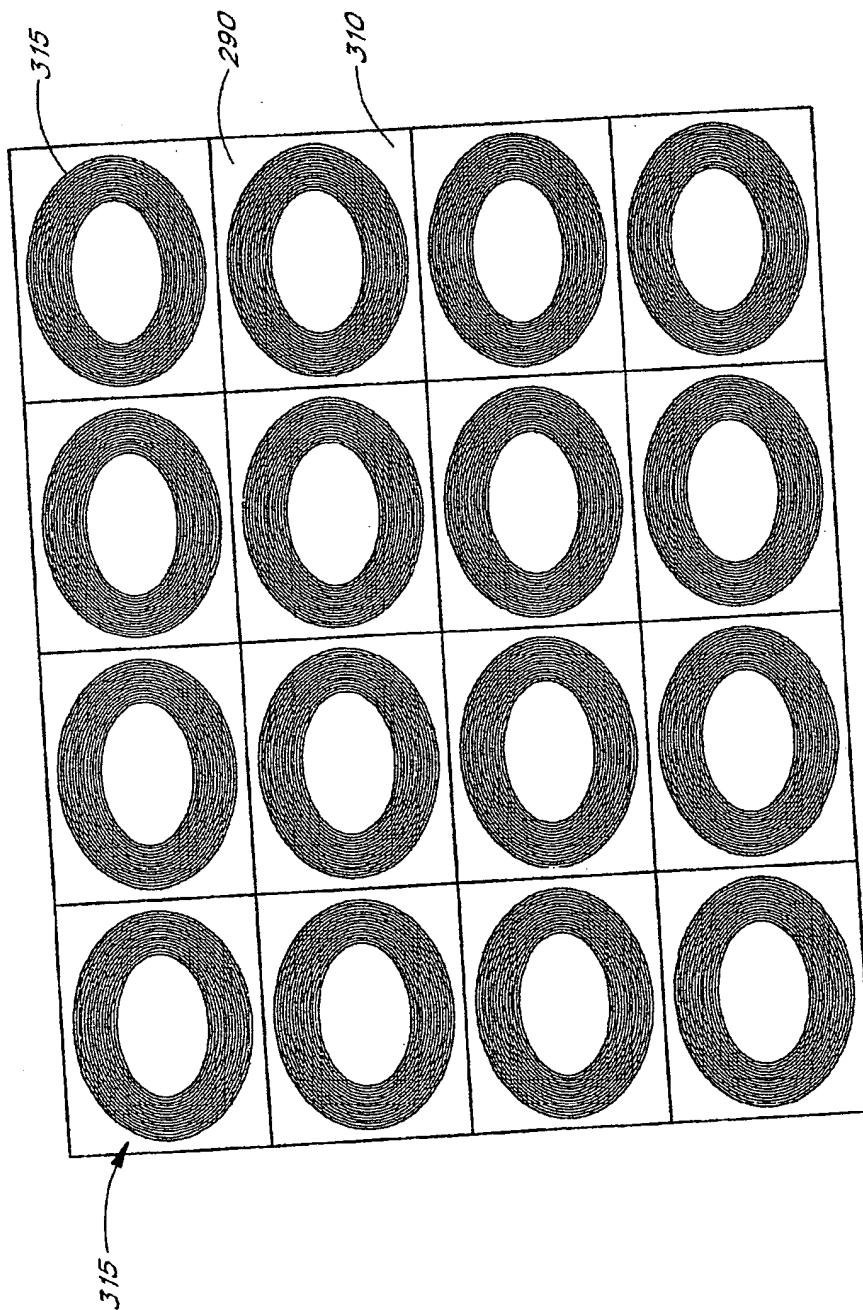


FIG. 17



ELECTRONIC TRANSFORMER/INDUCTOR DEVICES AND  
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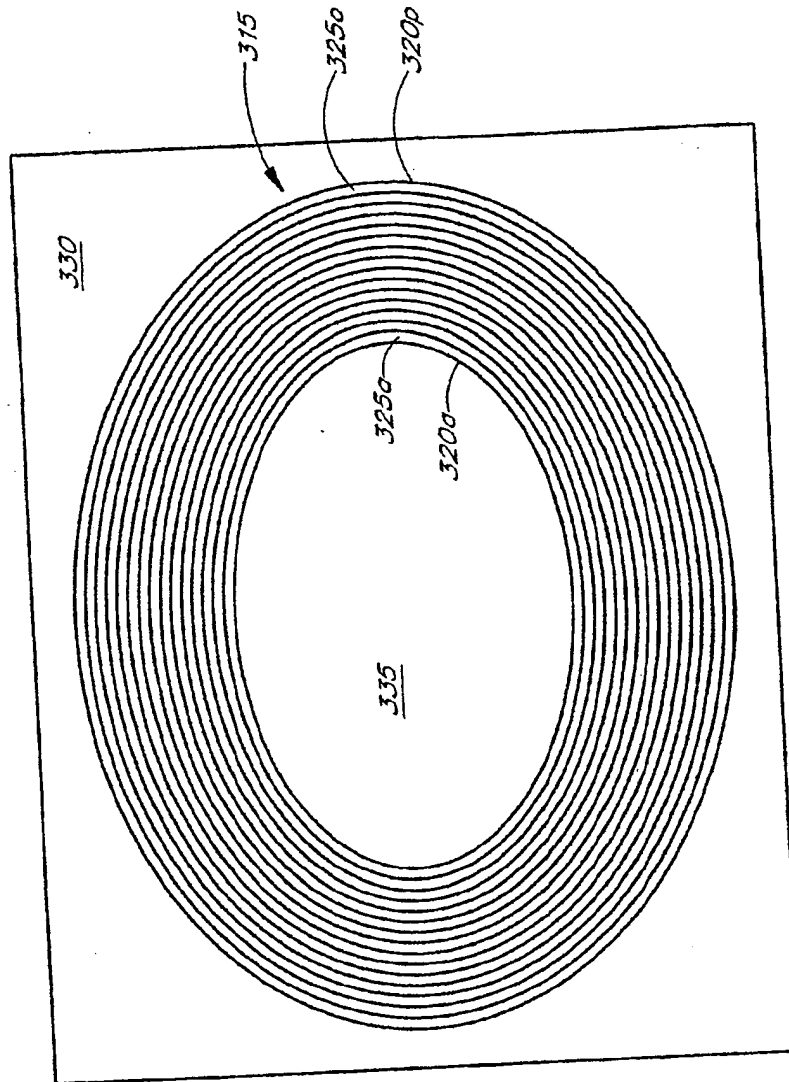


FIG. 18

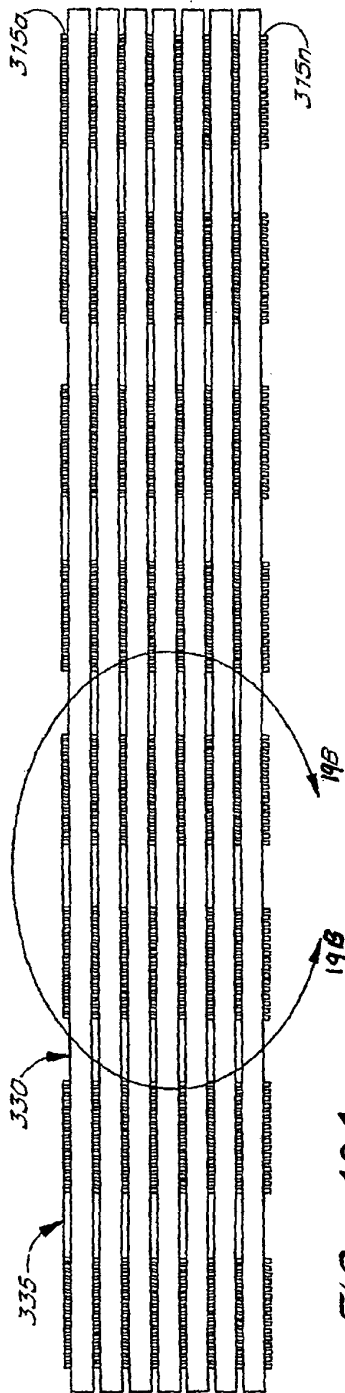


FIG. 19A

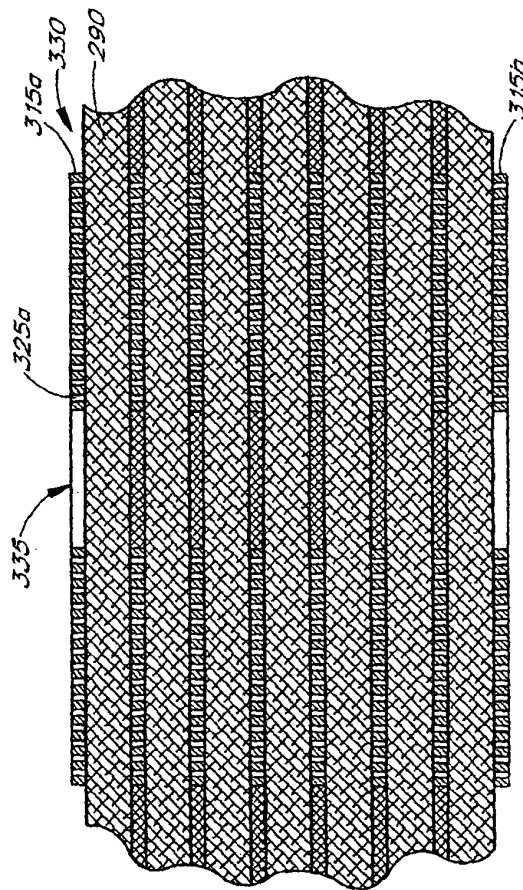
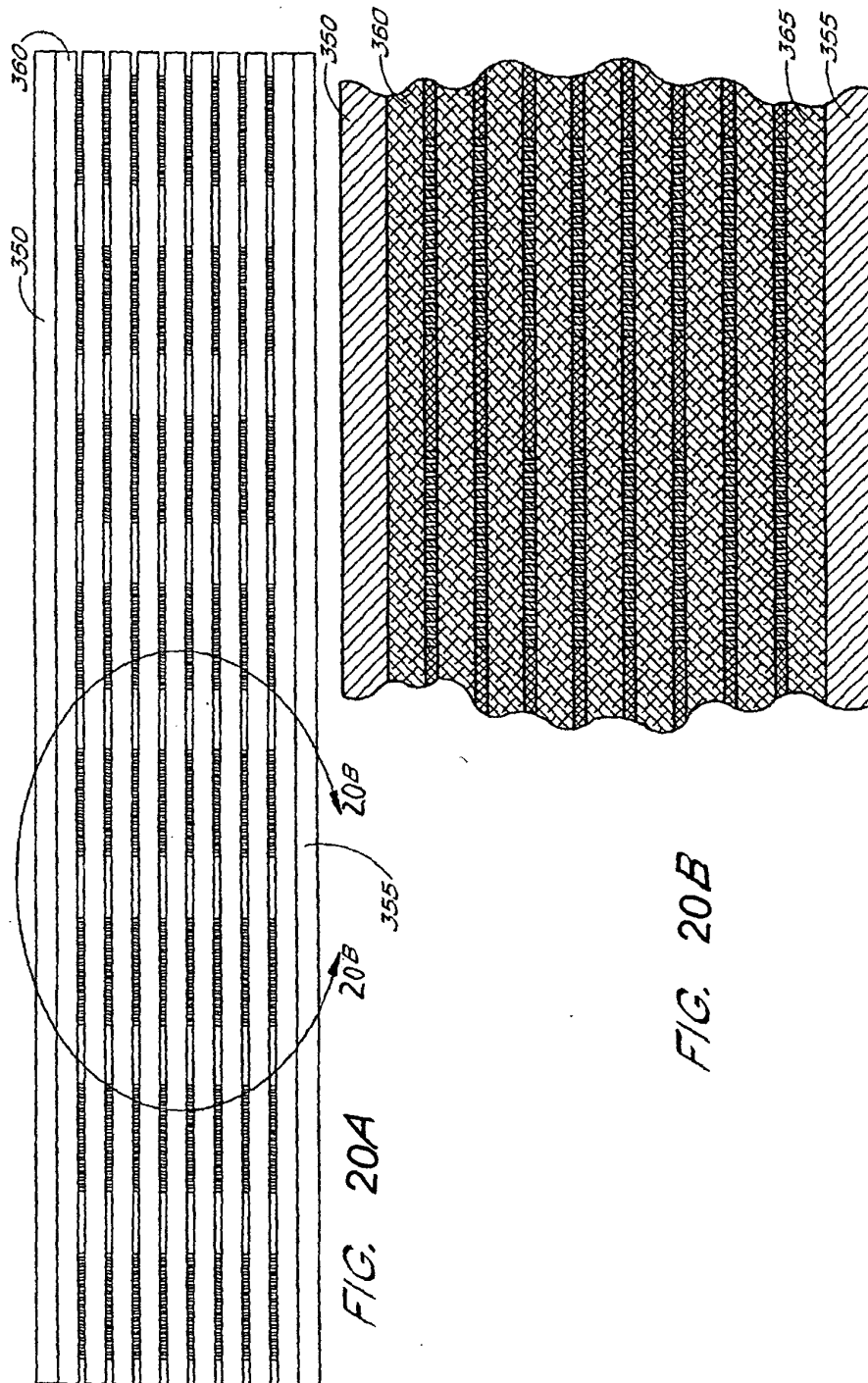


FIG. 19B

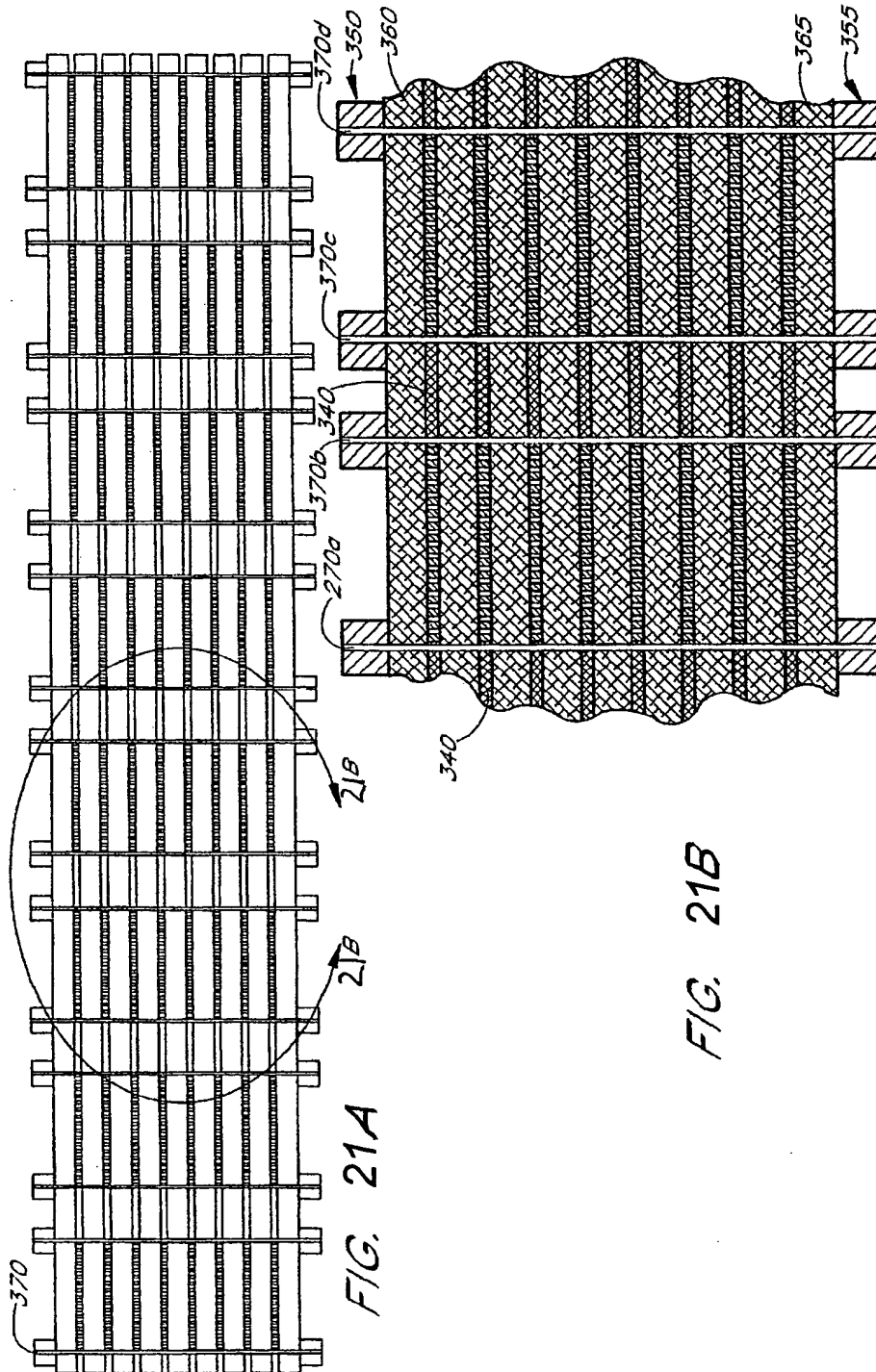


ELECTRONIC TRANSFORMER/INDUCTOR DEVICES AND  
METHODS FOR MAKING SAME

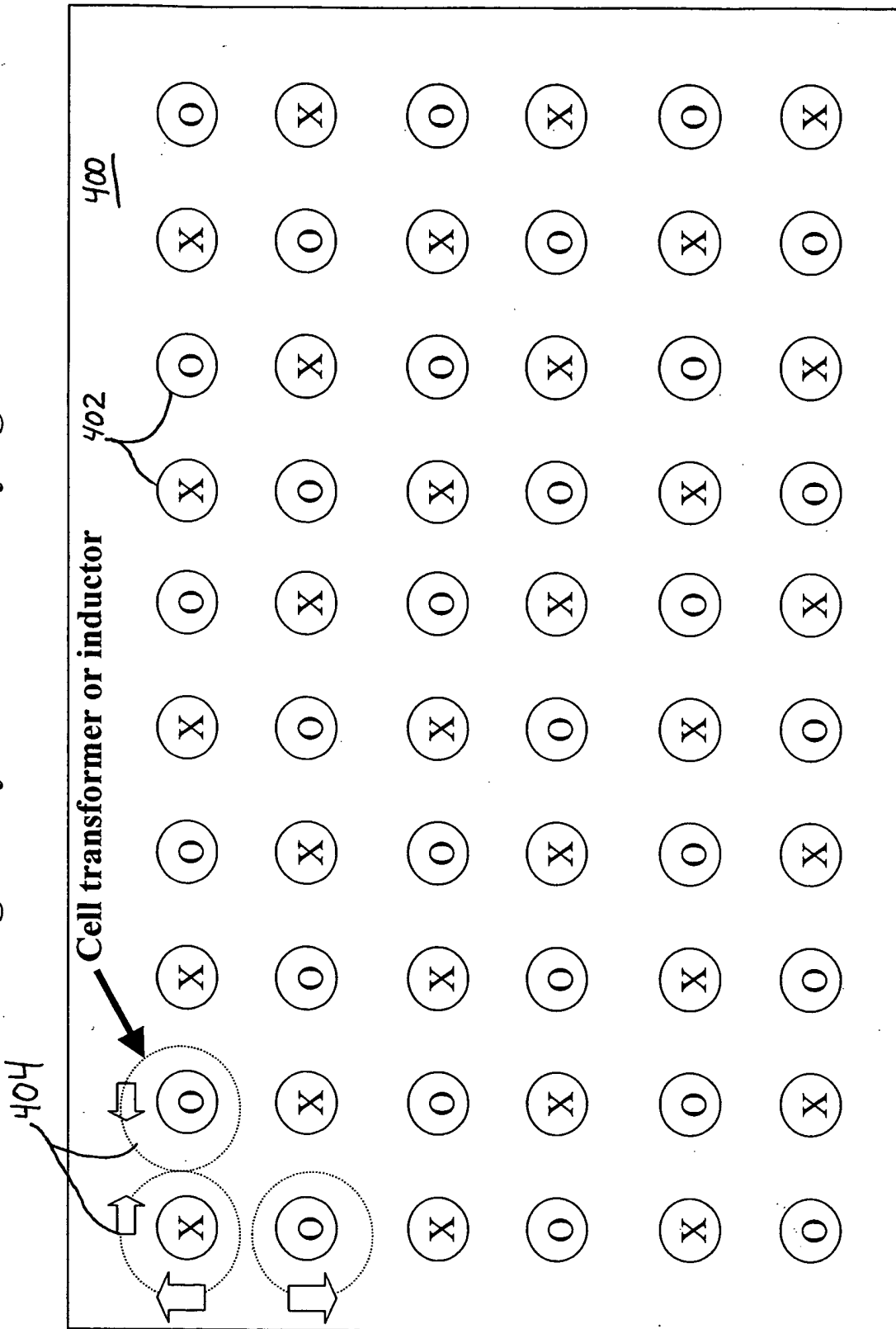
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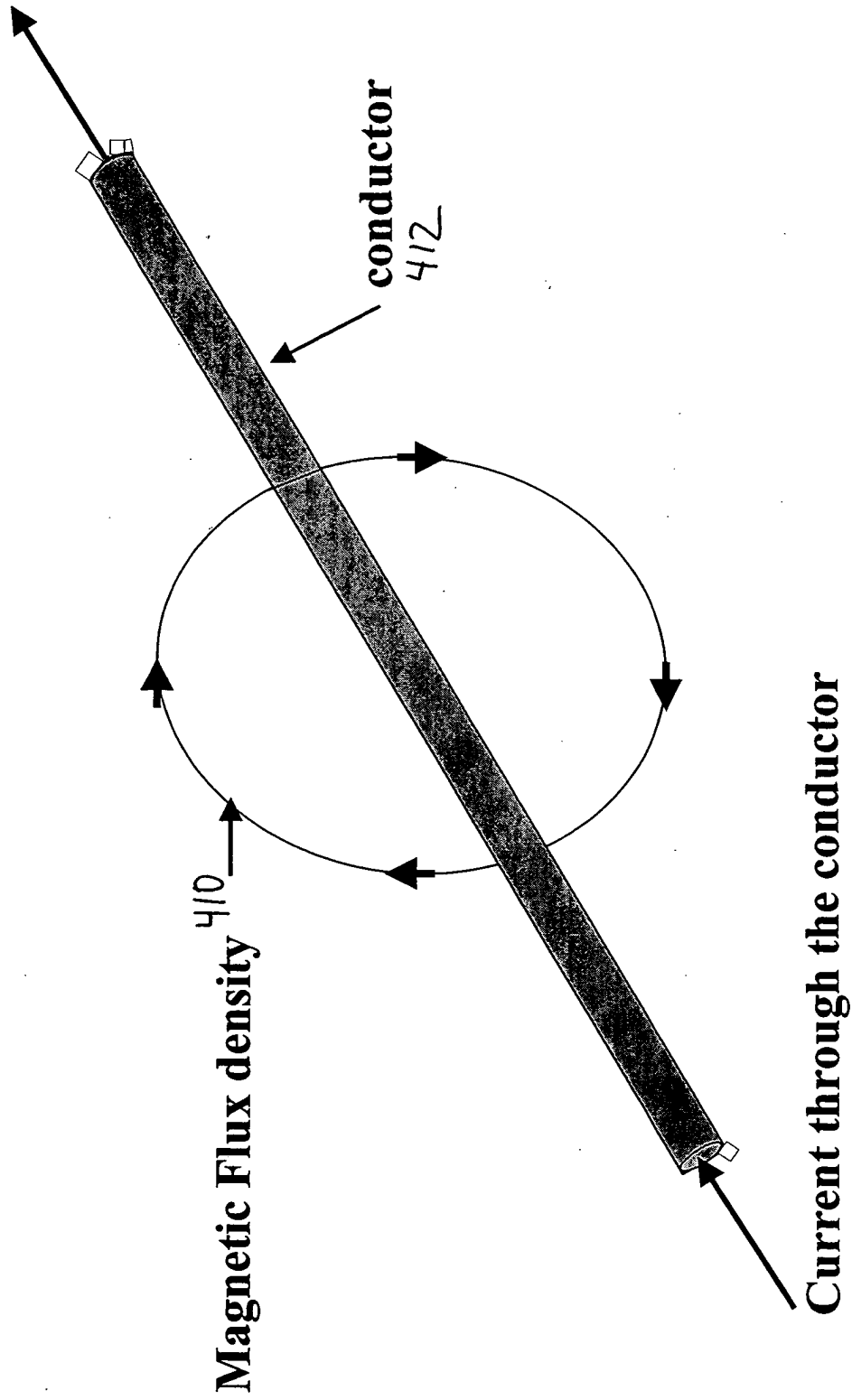
60 cell cores in a ferromagnetic slab  
each energized by 1 current carrying conductor



Via with current into hole
 Via with current out of hole

FIG. 22

## Magnetic Flux from a Single Conductor



**FIG. 23**

ELECTRONIC TRANSFORMER/INDUCTOR DEVICES AND  
METHODS FOR MAKING SAME

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Atty Docket: MFLEX.007A

Electric Field Intensity from an Enclosed area of Changing Magnetic Flux

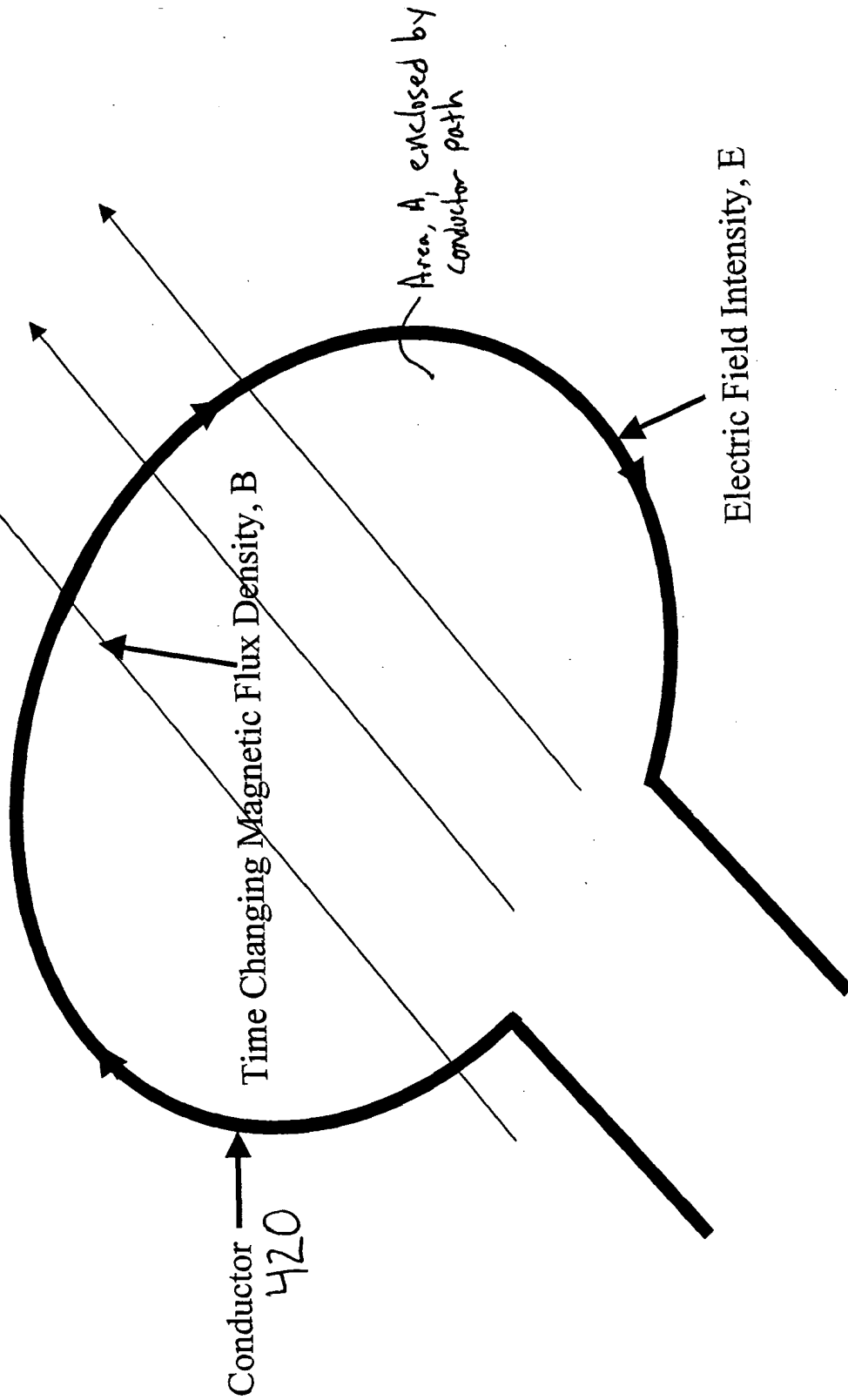


FIG. 24

40 cell cores in a ferromagnetic slab  
with each energized by 1 current carrying conductor

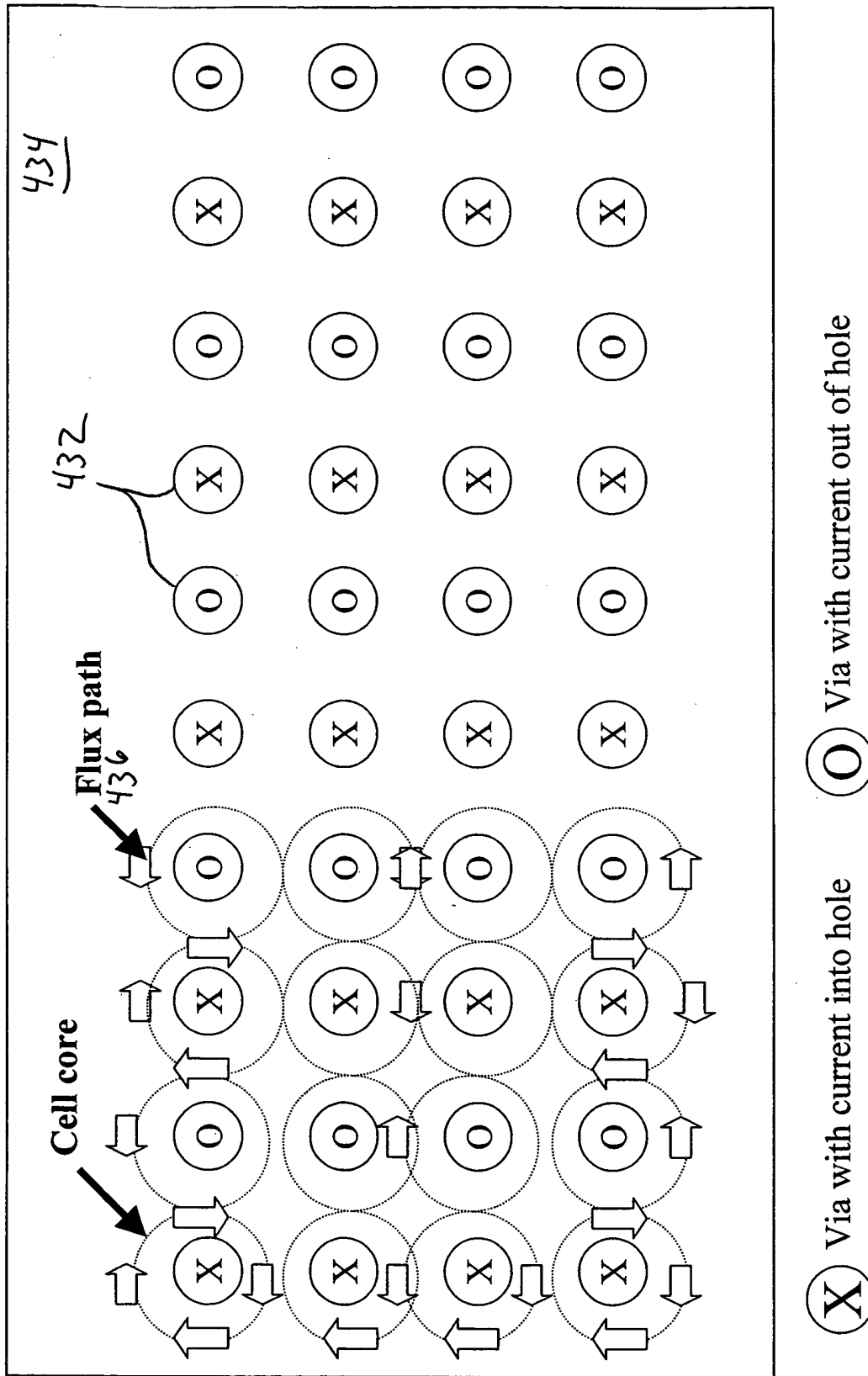
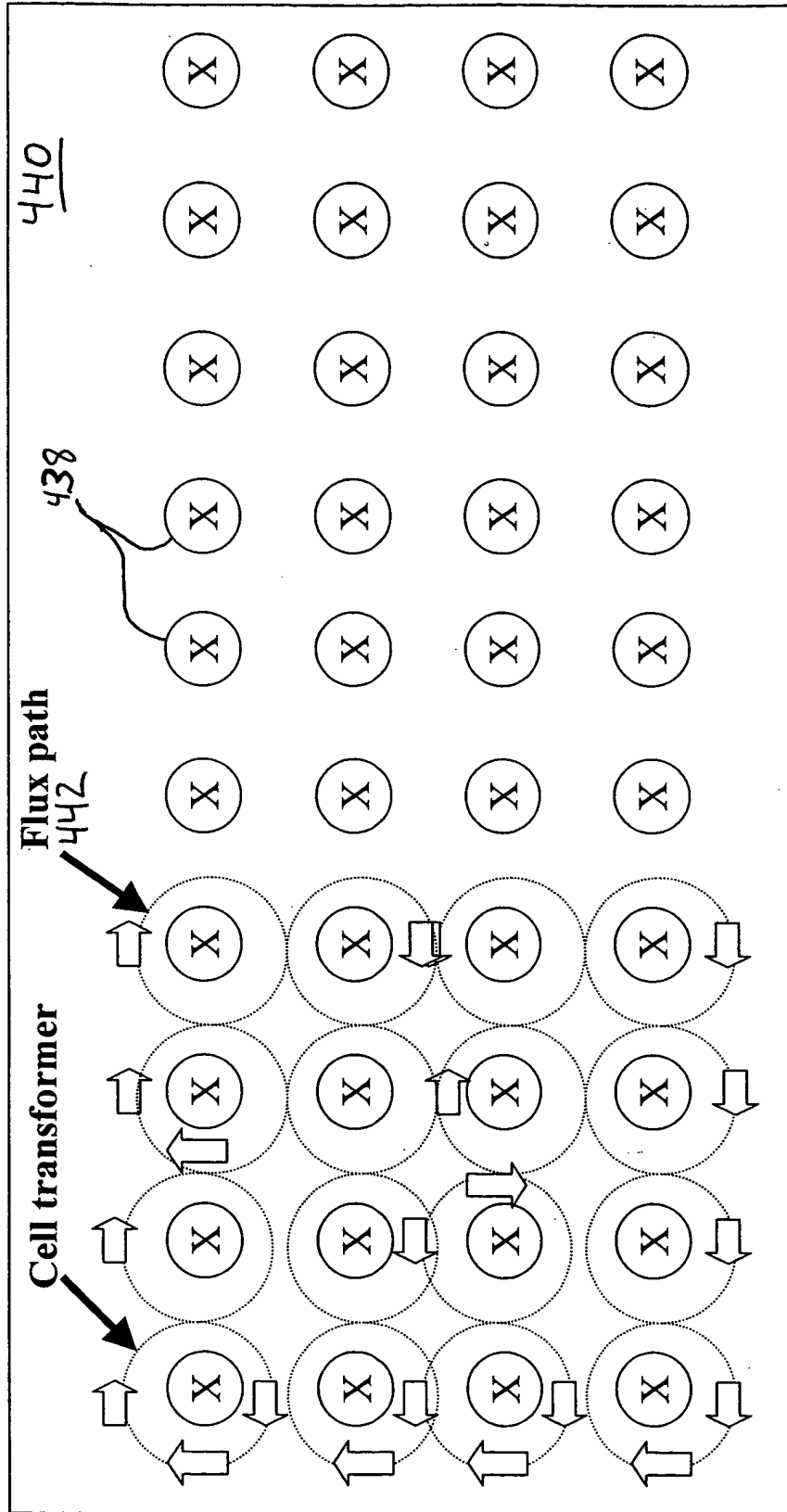


FIG. 25

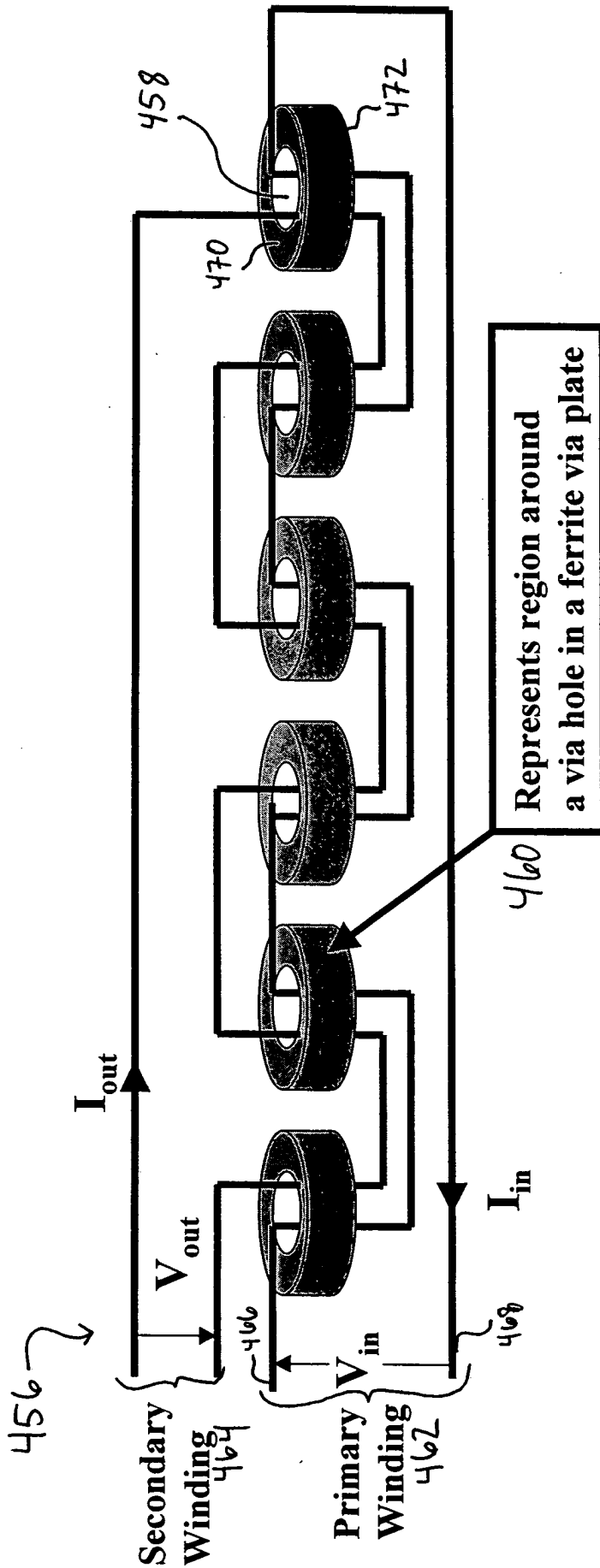


40 cell cores in a ferromagnetic slab  
with each energized by 1 current carrying conductor



⊗ Via with current into hole      ⊙ Via with current out of hole

FIG. 26



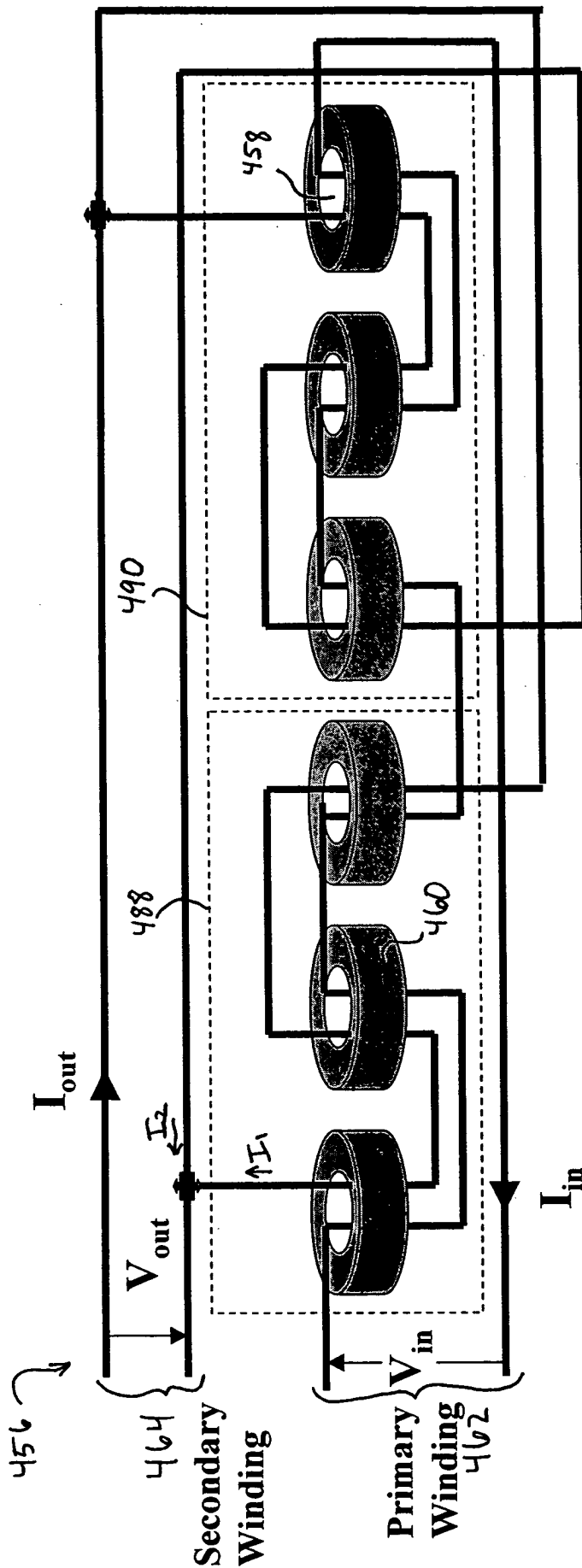
6 Cell Transformer  
turns ratio=1 to 1  
(primary to secondary)

$$V_{in} = V_{out}$$

$$I_{in} = I_{out}$$

Max current in Cell =  $I_{out}$

FIG. 27



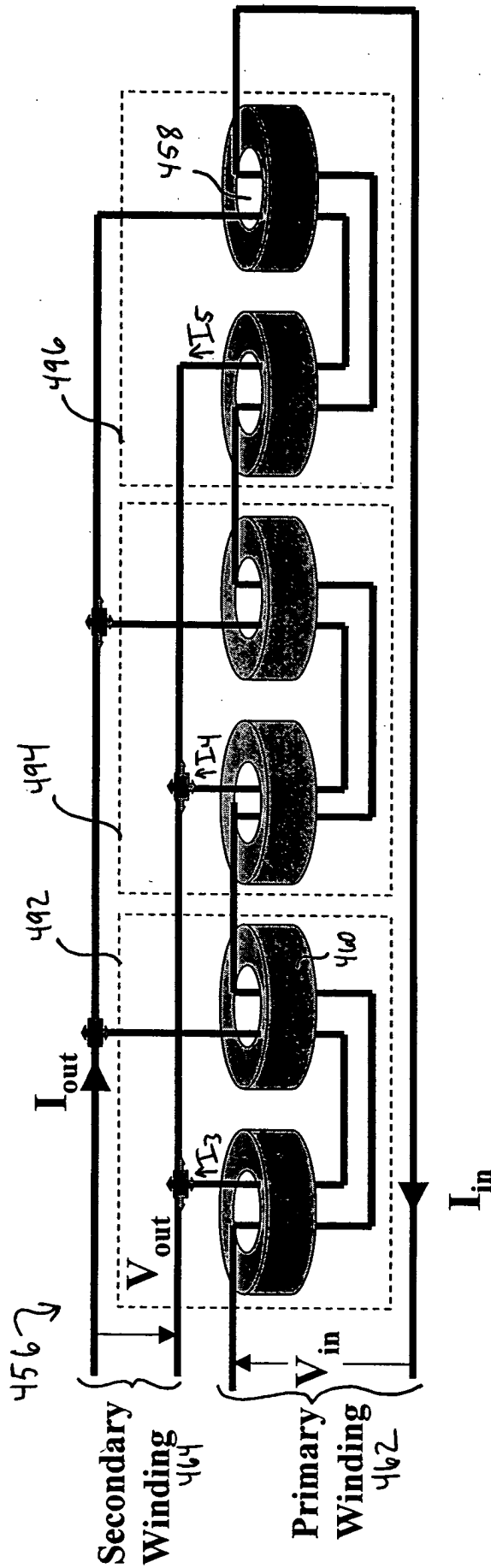
6 Cell Transformer  
turns ratio=2 to 1  
(primary to secondary)

$$V_{in} = 2 * V_{out}$$

$$I_{in} = 1/2 * I_{out}$$

$$\text{Max current in Cell} = 1/2 * I_{out}$$

FIG. 28



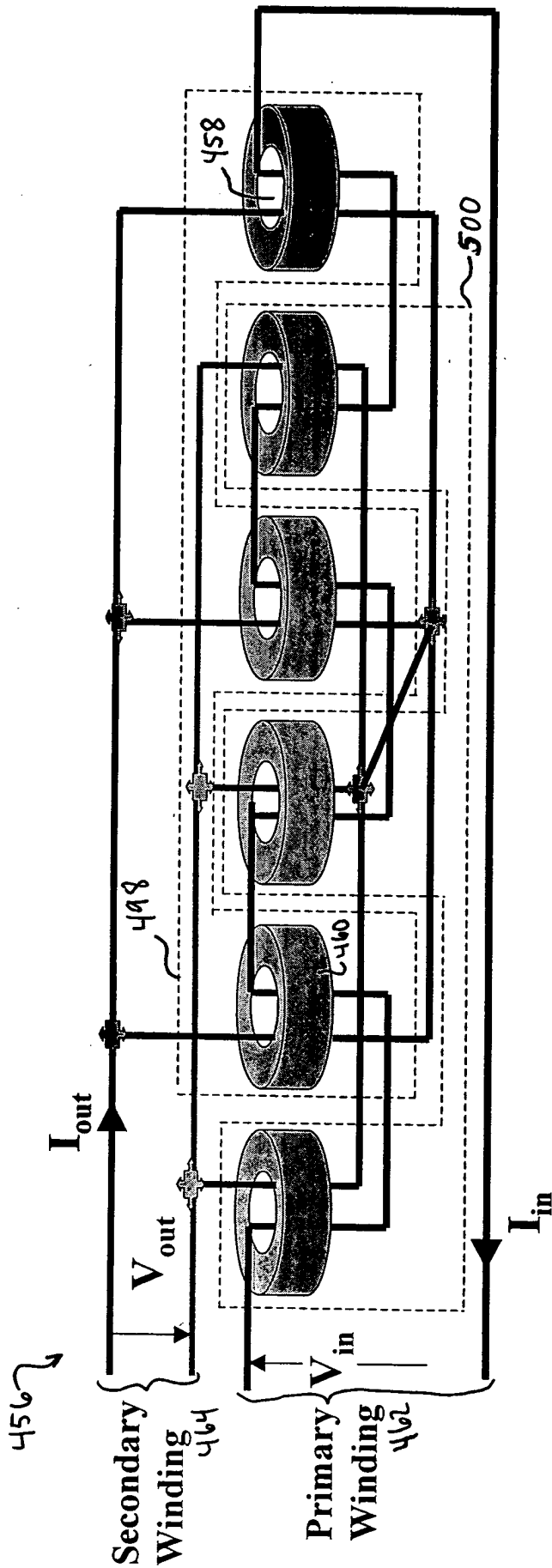
6 Cell Transformer  
turns ratio=3 to 1  
(primary to secondary)

$$V_{in} = 3 * V_{out}$$

$$I_{in} = 1/3 * I_{out}$$

Max current in Cell=  $1/3 * I_{out}$

FIG. 29



6 Cell Transformer example  
turns ratio=3 to 1  
(primary to secondary)

$$V_{in} = 3 * V_{out}$$

$$I_{in} = 1/3 * I_{out}$$

Max current in Cell =  $1/3 * I_{out}$

FIG. 30

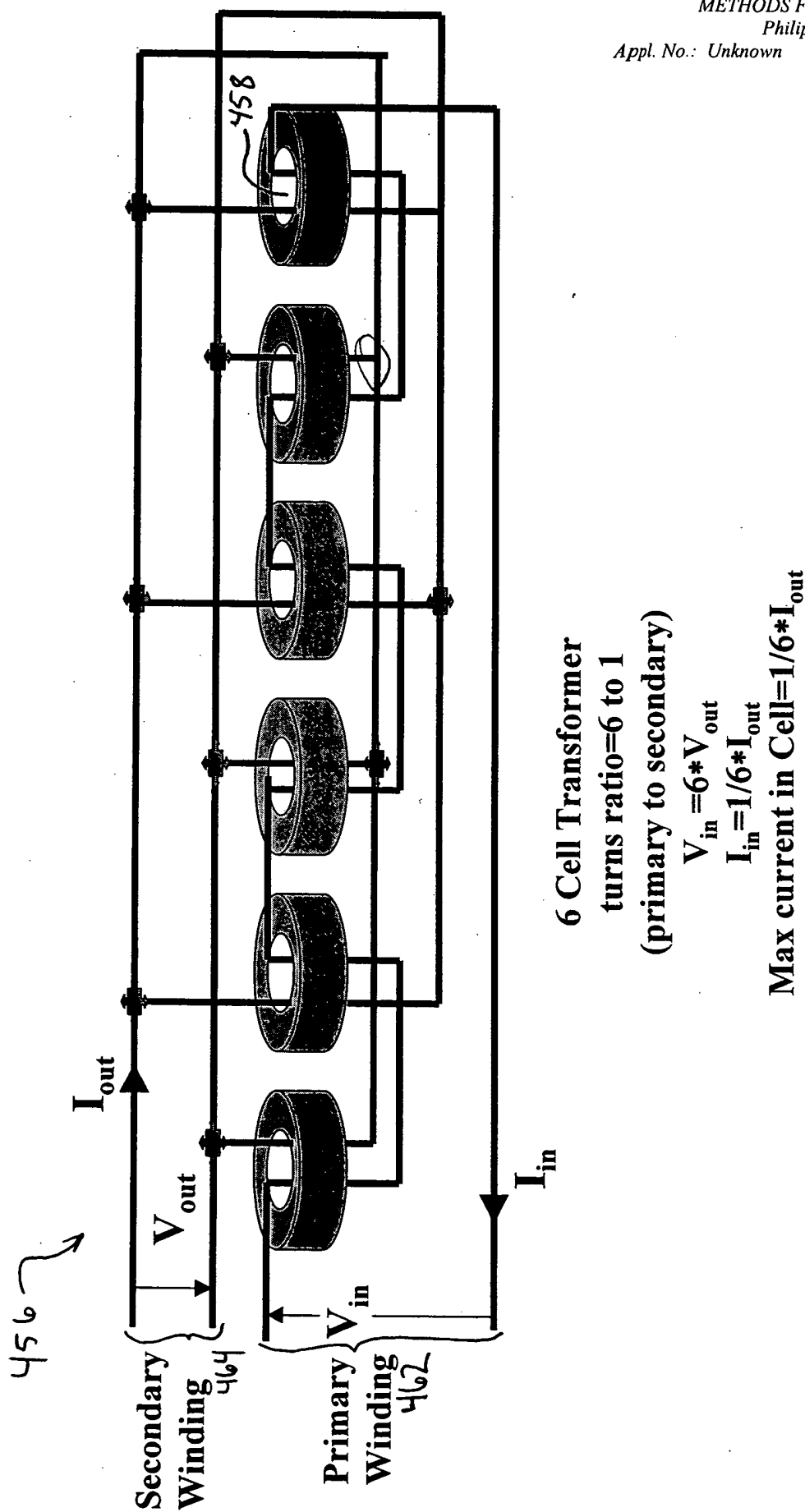


FIG. 31

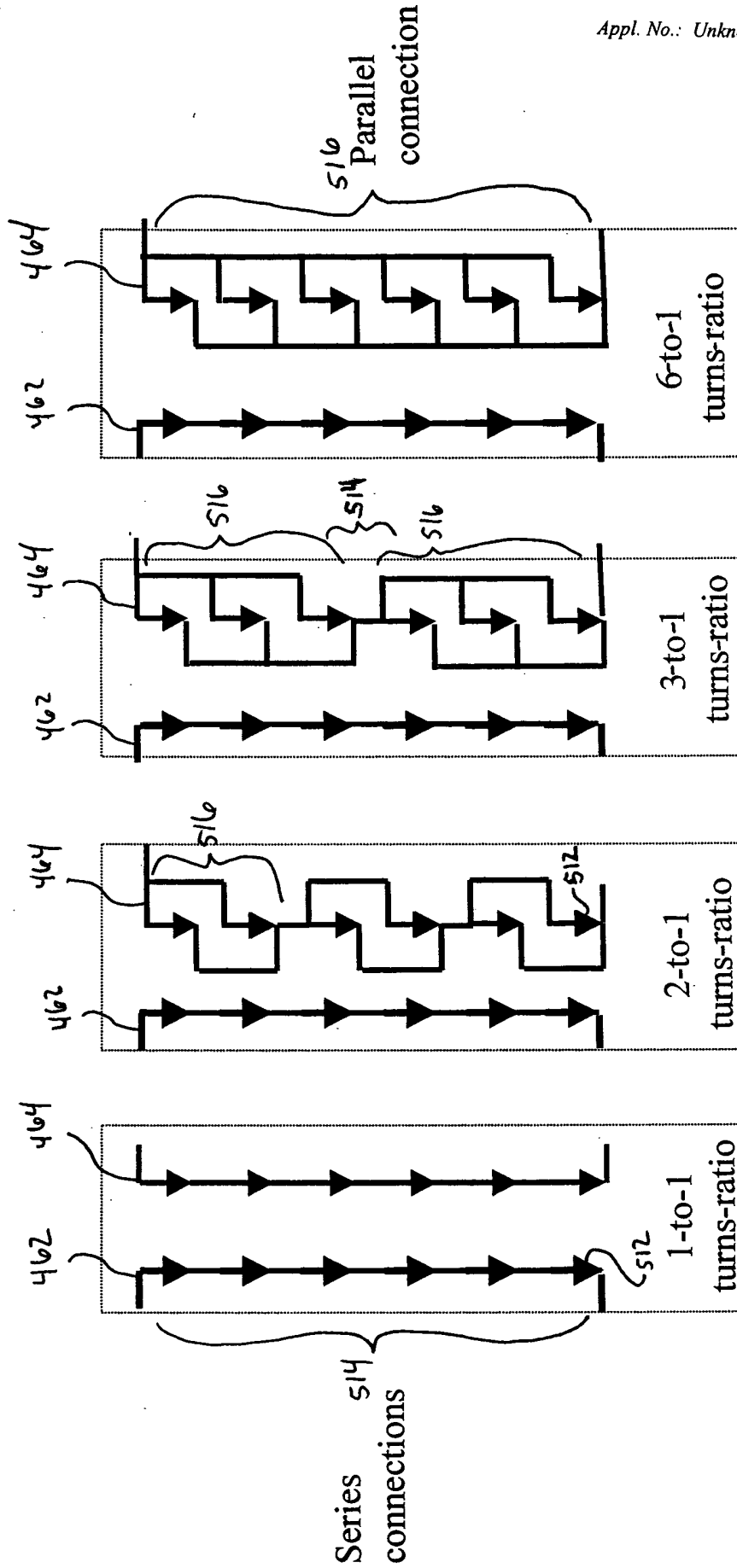


FIG. 32D

FIG. 32C

FIG. 32B

FIG. 32A

Symbolic Representation of 6 Cell  
Transformer Connections

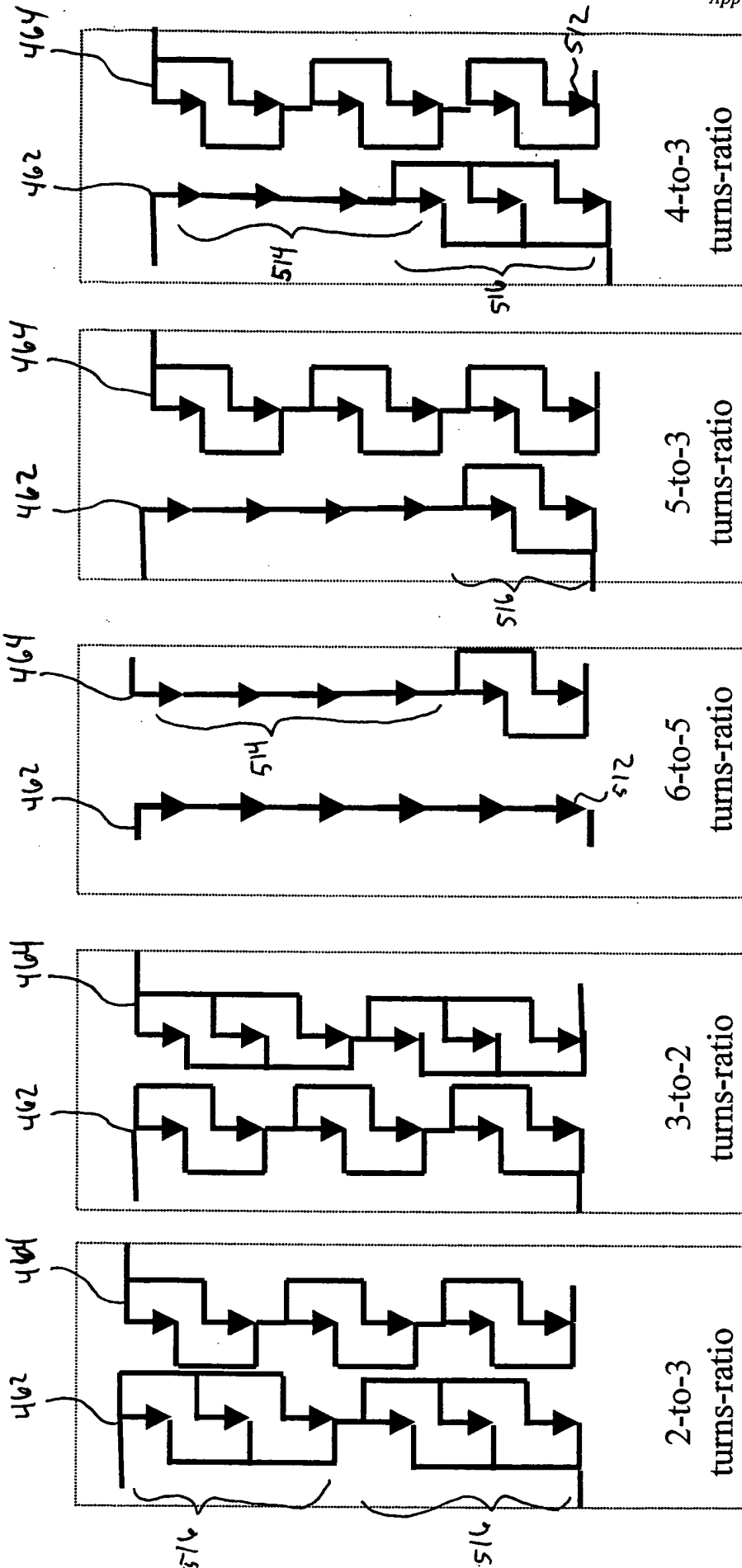


FIG. 32I

FIG. 32H

FIG. 32G

FIG. 32F

FIG. 32E

Additional Symbolic Representations of 6 Cell  
Transformer Connections



# Primary Connection of a 50 "Cell Core" 5 to 1 Turns Ratio Transformer

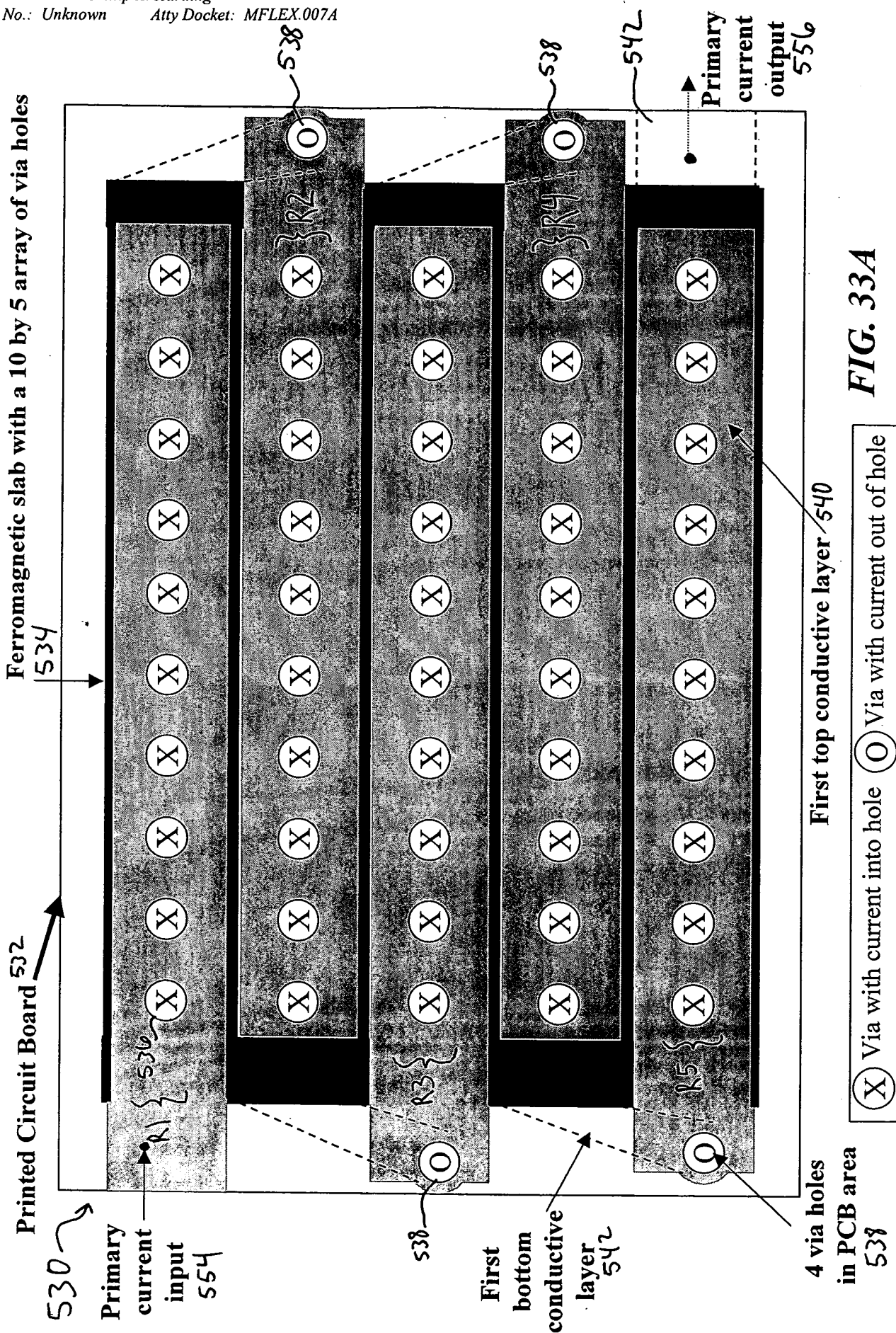
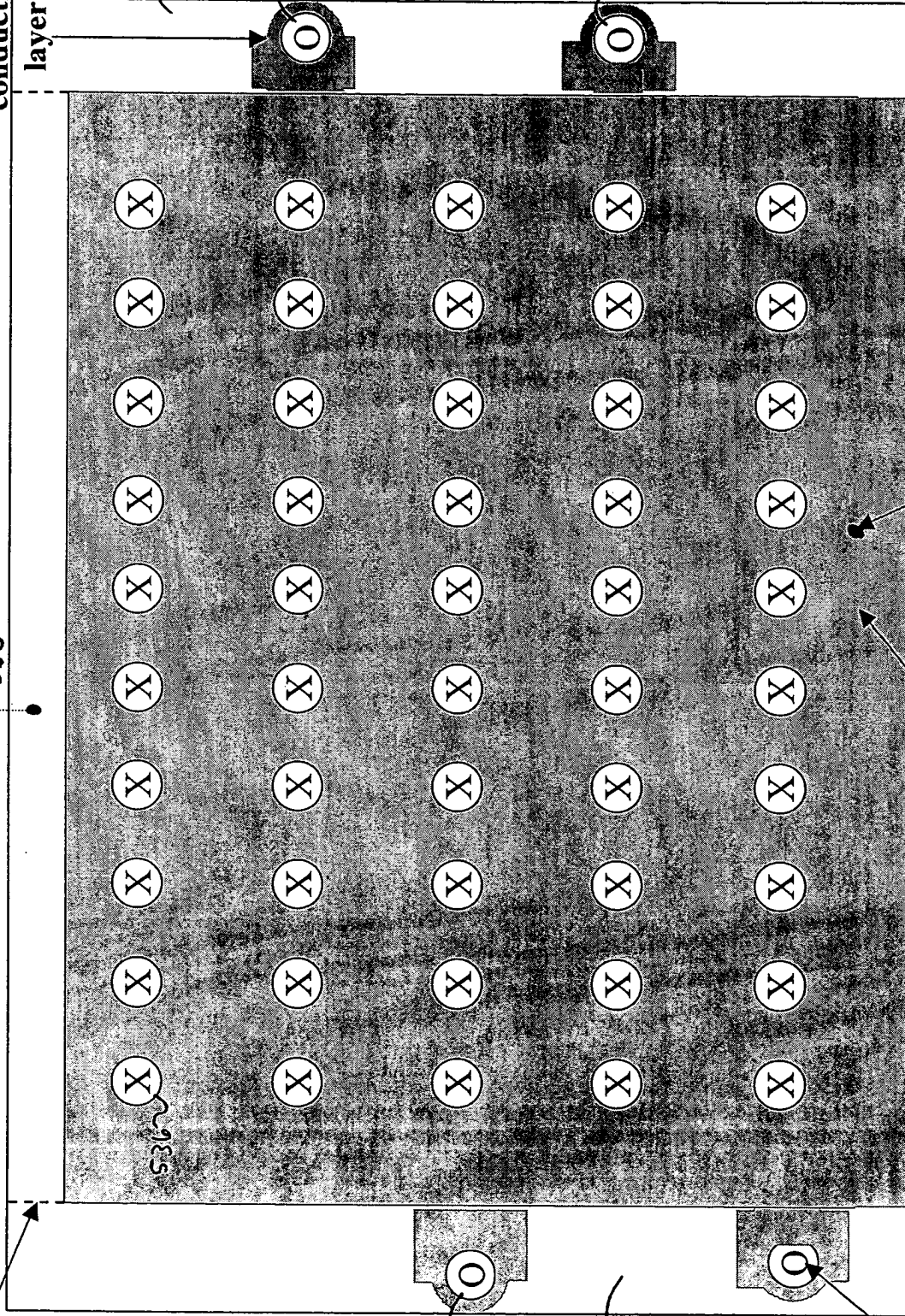
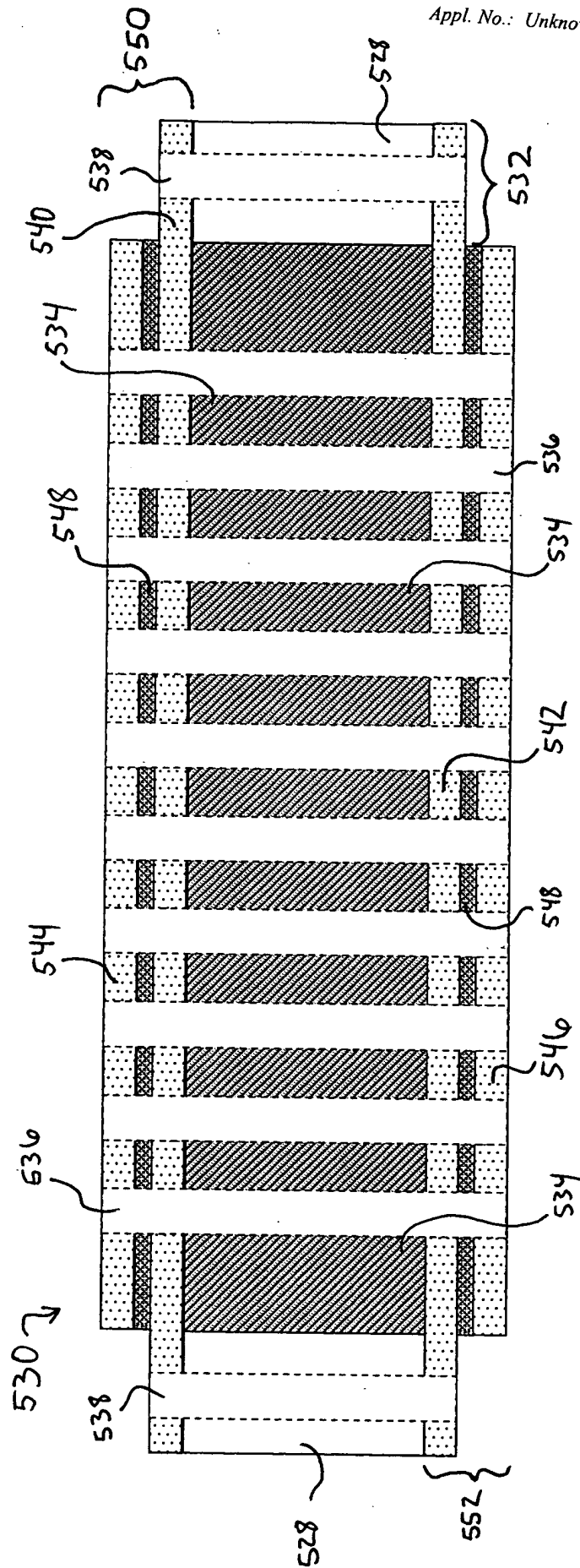


FIG. 33A

**FIG. 33B**





**FIG. 33C**